Editorial

THE Coronation of Her Majesty Queen Elizabeth the Second was a notable event in British history. It held the interest and imagination of the world at a higher pitch than anything which has ever happened to one person. No other nation could have staged the Coronation, and probably no other person could have passed through such a ceremony with so great a gathering of good will.

This world-wide attention was not gained by pressure publicity or extravagant sales efforts. The occasion neither demanded nor required them. It was something of deep significance to the British people all over the world, and the fact that it was attended by the highest degree of traditional splendor stemmed entirely from the nature of the Coronation itself.

That such an event should have brought visitors in their thousands to England from other lands was inevitable. That the cameras and microphones of the world should have been waiting on the abbey doorstep was evidence that millions were eager to see and hear the Queen's crowning. Britain welcomed them as her guests, asking only that no visible or audible interference should mar the solemnity of the occasion.

The whole Coronation was a masterpiece of organisation and planning which went through without a hitch. There was never more than a minute or two discrepancy between schedule and fact. And while all this was going on, the eyes and ears hidden away in the depths of the abbey were recording the procession of events with a realism unmatched in the past.

The task of controlling all this electronic equipment, both for sound and television, to say nothing of the film units, is somewhat staggering to contemplate. Critical listeners to the ceremony were struck by the smoothness and skill with which the continuity of sound was woven together. It would be necessary to consider very minor matters in an attempt to fault it—so minor in fact that the general atmosphere completely swallowed them up. We must remember, too, that the engineers had to cope with people moving about the abbey, with uncontrollable extraneous noises, with a large choir, an orchestra, and a magnificent organ. What a vast canvas was presented to them by all these things, and how magnificently they rose to the occasion despite the terrific tension and pressure to which every man was exposed.

The Englishman is not in the forefront of advertisement when his technical achievements are concerned. In fact I don't think British engineers receive nearly enough publicity for their achievements, many of which are monumental. This time it was a vast team of technicians, operators and engineers whose work was to withstand the critical examination of almost the entire world.

Their performance was not only a factual answer to a challenge, but a monument to their skill and standing in the technical world of today.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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VOL. 15, No. 4

SUBSCRIPTION RATES
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United Kingdom — £1/-/6 pa
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OUR COVER PICTURE

Mr. J. Mansour, of Southampton has turned to good account the results of wartime research into rocket and jet-powered planes. Now he designs flying models of current planes for sale to air-minded lads. The models are powered by his "Jetex" motors and a specially manufactured slow-burning fuel. Jet cars and boats are also available.

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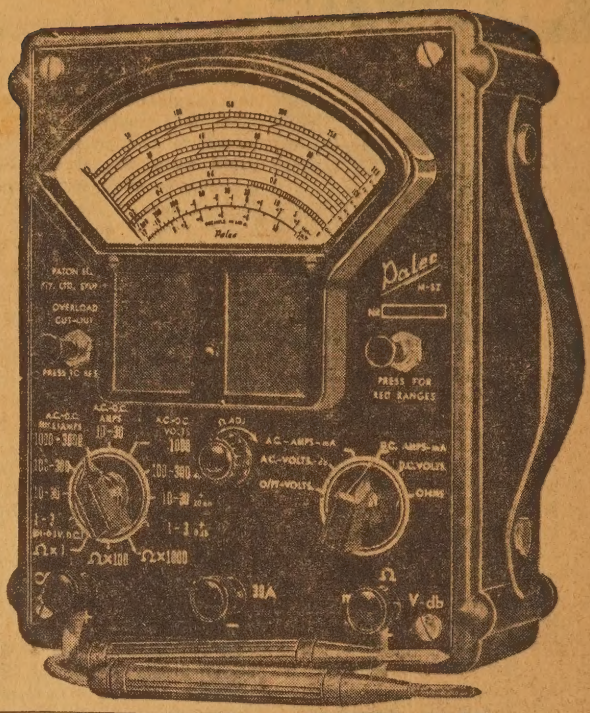

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" Ref. level 6 mW. in 600 ohms	3
Total	52

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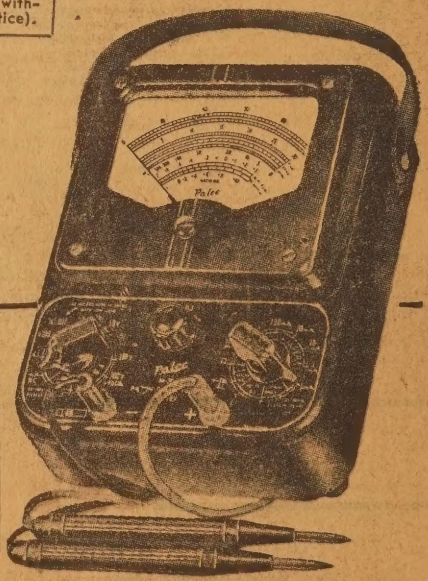
Model M.30/2, 30 range multimeter is indispensable for modern radio and electrical installation and service.



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Ranges

Volts D.C. 0/0.1-3-10-30-100-300-1000	7
Volts A.C. 0/3-10-30-100-300-1000	6
Current D.C. 0/1-3-10-30-100-300-1000 mA.	7
Current A.C. 0/1 mA. (for use with ext. current transformers)	1
Ohms 0/1000: 0/10000: 0/1 megohms	3
Decibels Ref. level 1 mW. in 600 ohms	3
" Ref. level 6 mW. in 600 ohms	3
Total	30

16 gns. Plus tax (Subject to change without notice).

Other features: Meter scale, 4"; all measurements from two terminals only; bakelite housing; test leads supplied Accurate reliable, keenly priced.

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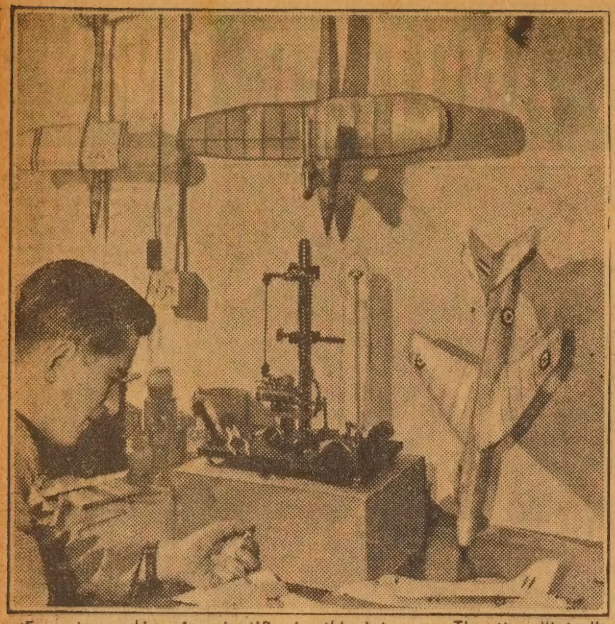
GEE, THERE GOES ANOTHER ONE!

British lads in the Southampton area have a unique opportunity of watching tests with high performance model planes, mass produced in a nearby "toy" factory. But how can they concentrate on this flying jet-propelled Hawker "Hunter" when a tiny jet-propelled helicopter has just taken off a few yards away? (See story next pages.)



Even toy-making is scientific in this jet-age. The tiny "jetex" motors are subjected to scientific tests for thrust. Here one type is shown on test in this delicate instrument. The larger model rocket-motors develop a thrust of about 5oz.

Efficient, but less detailed model aircraft than the "Hunter", are popular in Britain and overseas. This consignment of "Sharky" aircraft is being packed for export. They are made for easy assembly. Helicopters are made in the same way, are also good performers.

JET AGE COMES TO TOYLAND

A few short years ago the "ultimate" in model planes was powered with rubber bands and twin propellers. A little later youth got its hands on tiny petrol engines and began to build high performance models. Now the jet has come to the fore and completed the transformation from "toy" planes to a highly scientific hobby.

Boys of a Southampton secondary school, who belong to a model aircraft group, closely examine the scale-model of the Hawker "Hunter", which is fitted with one of Mr. Mansour's latest "jetex" motors.

Schoolboys who belong to a model aircraft group in a school near Southampton find plenty of thrills in flying this accurate scale model of the Hawker "Hunter" which gives a most realistic performance with its model jet motor.

MODEL aeroplane meetings the world over attract enthusiasts of all ages, from the small boys who look on, to the "fliers" themselves—and they range from around 14 upwards.

Designing and building models has become big business for a former wartime research engineer—Mr. Joseph Mansour, of Southampton.

Following up the wartime work he did on rocket research for the services, he has developed and perfected a featherweight "jet" engine which provides an entirely new method of propulsion for scale models and toys. His "jetex" engine, really a tiny rocket motor, provides the answer to model aircraft builders who want to reproduce faithful scale models of modern jet aircraft.

Mr. Mansour claims to have invented the only effective model rocket motor, for it solves the problem of controlled burning, giving a steady thrust to models. This all-British invention is now successfully propelling model aircraft, helicopters, cars, speedboats—even "spaceships"—in many parts of the world, for the Southampton firm not only makes this useful and compact little engine, but manufactures model builders' kits of parts and complete models for the enthusiasts—not all of whom are young.

SPECIAL FUEL

The secret behind the tiny "jetex" motor is special solid fuel. This was discovered and patented by a British chemical syndicate for use in wartime experiments with rocket-propelled aircraft and missiles. Since its removal from the secret list it has been produced in pellet form for the "jetex" engine.

Latest development from Mr. Mansour's fertile brain (he has been making model planes for more than 20 years), is the "augmenter tube", which increases the thrust of the "jetex" motor and opens up new possibilities in the model-making field.

Incorporating the "augmenter tube" with the most powerful "jetex" engine, Mr. Mansour's firm has developed a faithful scale model of Britain's faster-than-sound Hawker "Hunter" jet fighter.

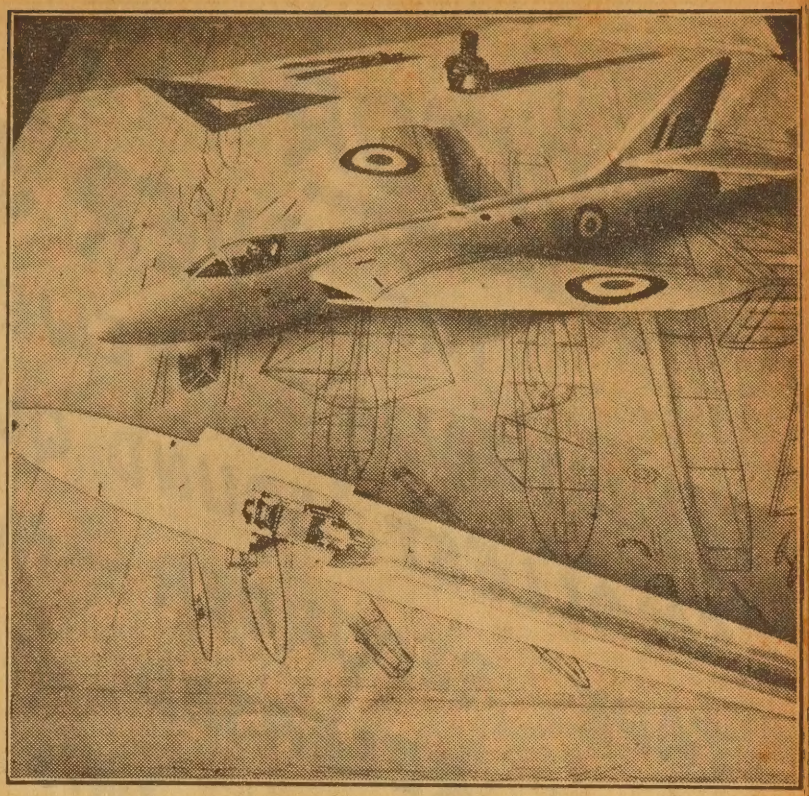
Model aircraft powered by these rocket-motors were displayed at the British Industries Fair held simultaneously in London and Birmingham from April 28 to May 8, 1953.

Proof that this tiny, but powerful motor is much more than a toy is the fact that it is in use in many research establishments for all sorts of special scientific applications.

Meanwhile, in the aircraft factories of the world, model planes have assumed tremendous importance and specialists are employed who do little else but build and test scale models.

Some of these are of all-metal construction intended to show the flow of air currents around their contours. Others, of wood, may be mounted on arms and used to measure limited characteristics like drag, &c.

Yet another type of model is that used for dynamic testing. While the aerodynamic models have been merely similar in shape to the real aeroplane, in the dynamic model, the engineers and model builders must reproduce in scale not only the shape, but the weight and inertia characteristics.



Secret of the propulsion unit in the scale model of the Hawker "Hunter" (seen here) is the tiny rocket motor designed by Mr. Joseph Mansour. In the cut away version (foreground) can be seen the motor fitted in the fuselage with air-intakes on both sides as in the real version. To give the motor extra power for propelling this large model, Mr. Mansour has evolved an "Augmenter" tube which boosts the motor. The tube is clearly seen in the cutaway model.

Here is a helicopter being launched on its first flight for the benefit of boys belonging to the model aircraft group who watch its performance with rapt interest. This model fitted with two rocket motors, can rise to 200 feet and glide slowly to earth again, travelling forward with the wind currents.

EDITOR

THE BYER '55' — AUSTRALIA'S NEWEST, SMALLEST 'SOUND QUALITY' TAPE RECORDER — HAS NOW BEEN RELEASED.

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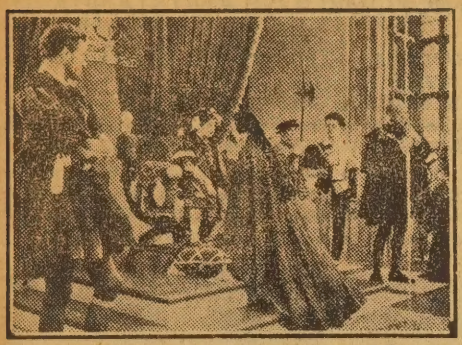
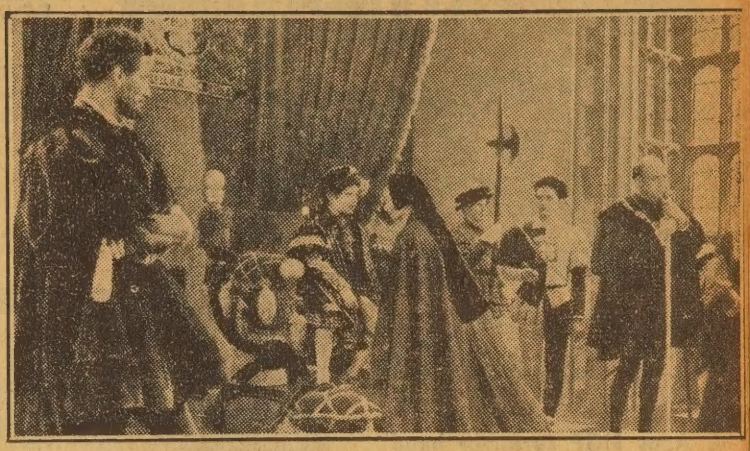
HOW THEATRES SHOW NEW FILMS





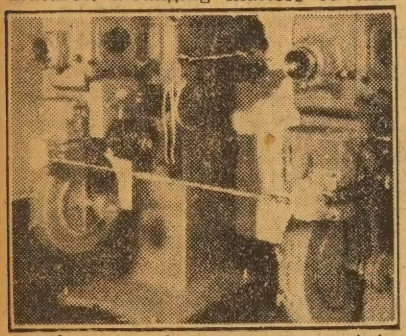
A scene from the MGM feature "Young Bess", reproduced in typical proportions for conventional presentation (above) and wide-screen presentation (right).

Sydney theatres have had to face special projection problems in recent weeks with the introduction of 3D and the so-called "panoramic" screen. What goes on before patrons file into their seats?

TO show the current 3D films without undue delays, three projectors are necessary. Some theatres have them already installed, others have had to be specially fitted.

In what sequence they are used depends on how long the main 3D feature runs. If it is less than 55 minutes, there are no difficulties at all, projection changes being made during the normal intermission. For longer features than this, there must be one intermission to allow the projectors to be reloaded.

Normal procedure is to use two projectors for the opening "flat" features, arranging matters so that



A front view of two projectors coupled by a removable bar between boxes attached to the sound heads.

one outer projector carries the last of these reels, plus the introduction to the 3D feature.

Meanwhile, one 3D reel has been loaded on to the idle machine and its companion reel is loaded on to the centre machine as soon as it is free. The two films must be synchronised to the exact frame and a check made to see that the shutters are also in synchronism.

To maintain this synchronism throughout the entire reel, requires that the projectors then be locked together.

Two systems have been used overseas and locally. One uses a pair of selsyn motors which "lock" the projectors electrically, so that one cannot gain on the other, even during the starting cycle.

The second system is mechanical, involving a bar which slips between two sockets connected by chain drive to the sound head on each projector. The bar can be slipped in or out of position in a few seconds.

Should the film break during a showing, both machines must be stopped and the film rethreaded exactly in synchronism, using film footage marks as a guide. If there are no marks on the edge of the film, it must be pulled through to the next change of scene and threaded up on the first of the new frames.

Later, when the break is repaired, the frames eliminated must be replaced by an exact length of opaque film.

Both prints carry sound tracks but normally only one is used for reproduction.

The prints can be shown separately elsewhere as "flatties."

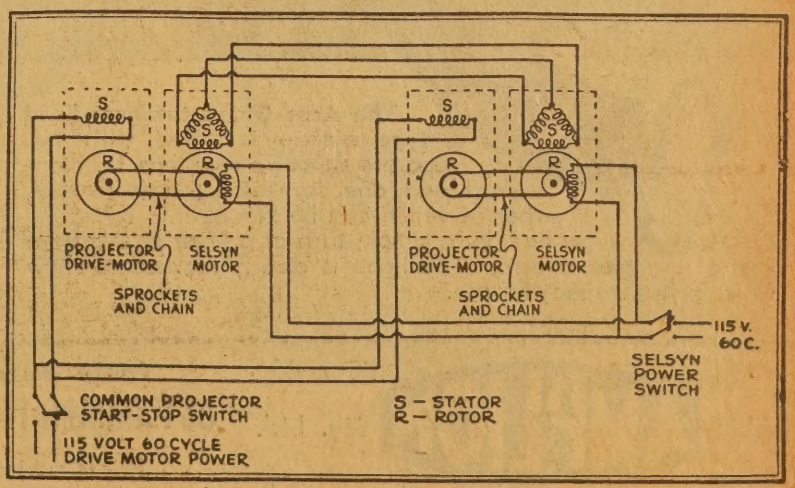
To avoid the necessity for frequent respooling, the 3D films are loaded on to 5000ft reels. These are so large that the take-up reel at least has to be swung on an extension below the usual spool position. To minimise the flywheel effect of the huge spools, they have been made with free-running sides, allowing the hubs to speed up or slow-down without too much drag or delay.

Oversize spools are only permissible nowadays because most films are printed on slow-burning nitrate stock, greatly reducing the fire hazard. Projectionists say, however, that it is disturbingly unstable, tending to warp and stretch under heat and stress.

This is one of the problems of exhibiting twin prints from separate machines.

Despite the greatest care in aligning the images on the screen, wander in the film throws the picture momentarily out of focus and adds to any inherent jitter in the pro-

(Continued on Page 101)



A typical circuit for selsyn interlock of two projectors.

"Acos" CRYSTAL PICK-UPS . . .

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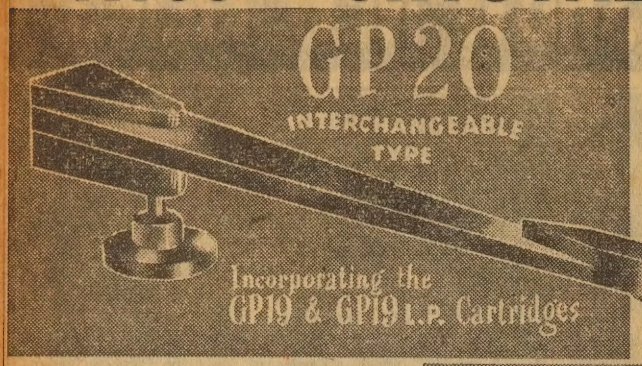
FOR MICROGROOVE AND STANDARD



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It is new in pick-up design, has 20 times greater output than comparable magnetic types, and automatic bass response while needle talk and motor rumble are practically non-existent.

Price £8/5/9
INCLUDING BOTH STANDARD & LP CARTRIDGES

The Acos HGP turnover head pickup is fitted with a high compliance Cartridge. The crystal is hermetically sealed in the housing, offering protection to any extreme humidity. Output nominally 1 volt on standard records and ¼ volt on L.P. records. The response characteristic is smooth with no resonance.

Price £5/17/6
INCLUDING CARTRIDGE

The Acos GP.30 turnover head type pickup is fitted with two separate sapphire styli, one for standard and one for microgroove records, either of which can be placed into operating position by a simple turn of a knob at the front end of the pickup arm. The knob is clearly marked to show which stylus is ready for use.

"Acos" CRYSTAL CARTRIDGES

(for GP 20 Standard) GP.19 **£2/19/9**
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(for GP.30 turnover) GP.29 **£2/19/9**
(for GP.10 standard) GP.9 **£1/11/6**
(for HGP Turnover) HGP.33 **£3/17/6**

The HGP.33 crystal Cartridge is a high compliance Cartridge which is used in the HGP turnover type Pickup.

The salient points of this Cartridge are:— Extremely high compliance and low mass; Completely hermetically sealed crystal unit; Universal mounting.

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SCIENTISTS RAID MUM'S KITCHEN

Though spending most of his day among delicate and costly instruments, a modern scientist is just as likely to find the solution to a pressing problem in his own wife's kitchen. So says J. D. Morton of the General Electric Laboratories.

NEW problems constantly arising in pioneering work necessitate use of whatever suitable materials are at hand. Research workers often use standard laboratory equipment, but when this is impossible, they resort to articles like empty kitchen containers.

Dr. A. Harry Sharbaugh, a chemist in the G-E laboratory, uses a rat trap for studying electric pulses.

Attached to the trap is a carbon contact brush. When the trap is sprung, the brush sweeps across a stationary metal contact. For 1/1000 of a second, it connects a storage battery with an oscilloscope, which measures the electric pulse produced.

Dr. Sharbaugh found that the trap gives a dependable performance which can be reproduced accurately time after time. The tests are part of an over-all experiment to determine why various electric charges break down insulating materials.

FROM THE CAR?

A windshield wiper mechanism serves laboratory chemists in powering a stirring rod that keeps fluids in a freezing bath from developing uneven temperatures. The operation is part of a procedure to determine the molecular weights of new chemicals.

A hydraulic auto jack was used by Dr. F. P. Price, another chemist, to test the strength of various plastic materials. Steady pressure is applied to the jack mechanism by means of gas piped into the hydraulic system. The force of the jack shaft against the plastic sample applies a unique stretching and pulling action not obtained by standard methods.

Two young chemists at the laboratory recently incorporated an old syrup can in a device used to test the tensile strength of silicone rubber strips.

They employed a system of pulleys to carry a tiny cable from the rubber strip to the handle of the empty container. Tension is applied to the sample by running water at a steady rate into the container.

When the sample finally gives way, the can drops onto a microswitch which shuts off a timing device.

Famed weather scientist Dr. Vincent J. Schaefer long has made ingenious laboratory use of homely devices ranging from chunks of dry ice to plastic bottles, and liquid lenses to oil cans.

In quest of an effective generator for spreading protective military smoke screens during World War II, Dr. Schaefer had trouble finding one that would produce the proper size smoke particles.

He knew through experimentation that small particles did the best screening job, but must be produced from a tiny opening at high speed. He finally hit on the idea of using an ordinary machinist's oil can, with its long spout and narrow nozzle.

By boiling ordinary lubricating oil in the can, he sent smoke hurtling from the spout in a cone-shaped pattern at the speed of sound. Later the generator adopted for use in all military combat zones proved to be a larger version of this oil can.

Dr. Schaefer has used chunks of dry ice, the sudden cooling effect of air released from a "pop" bottle and a pricked toy balloon, to turn supercooled water to snow.

FROM THE BOUDOIR?

Stealing a march on milady, Dr. Schaefer uses a pliable plastic cosmetics bottle to study effects of rapid pressure changes on moisture. The cosmetics bottle is attached to the open end of a glass flask, in which moisture has been introduced. By rapidly squeezing and unsqueezing the plastic bottle, a dense cloud is produced for study in the flask.

Recently Dr. Schaefer needed a camera lens that would photograph 120 deg of sky outside the laboratory window. Knowing that only a few such glass lenses had ever been constructed, he filled a glass flask with oil of a high refractive index.

By placing the liquid lens between his camera lens and the window, he can take pictures of one-third of the sky with a single snap of the lens.

"SHE SHALL HAVE MUSIC WHEREVER SHE GOES"

A Berlin firm has developed a radio that can be fitted to bicycles. It is called the "Velophone". The loudspeaker is incorporated in the headlamp and the radio is contained in a tube 10in long and 2in wide. Power is provided by a dynamo serving a battery below the saddle. Cost is about £4 sterling.

To prevent their babies-in-prams from screeching while they "park" them outside shops, mothers now have a new gadget to help them. It is a wireless set built in to the perambulator which even sports an extending aerial. Mother still has to bend down when tuning in to baby's favorite program.

HEAR THE NEW ML20-5A HIGH FIDELITY AMPLIFIER . . .

The ML20-5A incorporates the new improved Fidelity Control Unit

MODEL ML20-5A complete with fidelity control

£68/2/8 (OR LOW DEPOSIT, EASY TERMS)

Amplifying unit — 20 watts output.

Valves: 1 x 6AU6
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2 x KT66
1 x 5V4G

Output Impedance—2 to 4 ohms or 12 to 18 ohms. Supply Voltage: 220, 240, 260 volts AC 50 cycle supply.

FIDELITY CONTROL

Valves: 1 x 12AT7
1 x 12AU7

Inputs: Radio, microphone, pick-up.

Tuner power supply available.

Controls, left to right:

No 1—AC on/off switch and volume control.
No. 2—Sharp cut off filter, Williamson type, 3 positions.
No 3—Bass control, rise and fall.
No. 4—Treble control, rise and fall.
No 5—Input selector, 5 positions.

Position 1: Radio.
Position 2: LP records.
Position 3: 78 American records.
Position 4: 78 European records.
Position 5: Microphone.

20 Millivolts input to pick-up terminals for 20 Watt output.

General: Compensation or record characteristics built into control unit, independent control of bass and treble. Sharp cut off filter for minimising scratch on old records without affecting operation of bass and treble controls.

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U.S. TV POSITION IS CONFUSED

According to recent reports, television in the U.S. is suffering badly from "growing pains". New stations just aren't materialising as fast as was expected, advertisers are complaining about high rates, and ultrahigh frequency has developed a lot of defects.

EDUCATIONAL video doesn't seem to be able to get going, and theatre TV still is far off. Color TV is just "in an awful mess".

According to Changing Times the Kiplinger magazine, television is mired down in a quicksand of good intentions, bad planning and plain, sticky trouble.

New stations simply are not being built in the numbers anticipated. Ultra-high frequency isn't panning out as expected. Educational TV progresses at a snail's pace. "Pay-as-you-see" TV is snarled up in a legal wrangle. Color TV is still pretty far off.

Here is the picture:

Some people think that 2051 new TV stations are just over the horizon. That's the number the Government announced when it lifted the "freeze" on TV last July and invited applications for licences.

It sounded like good news. People in towns of less than 50,000 could look forward to their own local television stations.

Folks in big cities, with one or two stations already in operation, could look forward to more stations and a better choice of programs.

FOR "HIGH-BROWS"

Culture bugs interested in music, drama, education and other intellectual fare were promised programs designed exclusively for their tastes, since one out of 10 of the new stations was to be "non-profit and educational".

Thus far the record is not so good. In 10 months only 325 of the planned 2051 new stations have been authorised. Fewer than 60 of these have gone on the air. As for those educational stations, licences for only a few of the planned 242 have been granted. And just two—one in Los Angeles, the other in Houston—are close to being in business.

Those first 100 or so television stations built back in 1947-48 really coined money. They made from three to 10 times as much as radio stations ever did. Now the bloom is off the rose.

Operating costs move higher all the time. The balance sheets for some stations don't make cheerful reading. For an example of the financial obstacles confronting a potential builder of even a small TV station, look at what it costs to get one operating.

First, a minimum of 300,000 dollars for buildings, transmitter, studios, cameras, &c.

At least another 150,000 dollars to carry the overhead, pay the help, and meet the bills until profits (if any) begin to show.

In comparison it costs about 60,000 dollars to build a small radio station and about 80,000 dollars to operate it for a year. Little wonder, then, that many a prospective TV station builder is reconsidering.

High costs have slowed down advertisers' enthusiasm. Station time alone for an hour-long night-time show on NBC's TV network costs 58,575 dollars. An hour on NBC's bigger radio network costs less than 25,000 dollars.

Talent for TV shows comes high. So the advertisers are cooling. Hour-long shows are cut back to half an hour. Live programs are replaced by cheaper film shows.

If a new station were to go up in your town, would advertisers buy time on it? They might not if other stations there already were operating successfully.

Now the bloom is off the rose they're not jumping on that TV bandwagon.

POOR SUPPORT

Local businessmen can't be expected to support new stations in their communities. Few of them have been able to buy much time on existing stations.

Educational TV limps along because of two crippling ailments—not enough money and not enough public support.

You know what it costs to set up and operate a TV station. You can imagine, then, how tough it is to raise the money to build a station, run it, and plan for the future when all the money has to go in and none is to come out because educational TV must be non-profit.

Enthusiasm for educational television is hot in some quarters. The National School Boards Association claims that "TV affords one of the greatest opportunities for education advancement".

A realistic forecast is that 75 or 100 educational TV stations eventually will be set up—a number well below the 242 once anticipated.

PAY-AS-YOU-SEE

Pay-as-you-see TV is one proposal to solve some of the basic money troubles. It would work this way: First-run movies, Broadway shows, and the like, would be telecast on special lines or channels. Only specially equipped TV sets could receive them. People who owned such sets would pay a monthly fee for the service the way they now pay their phone bill.

This idea has been kicked around for a couple of years, but there's no telling whether it will ever be used on a big scale.

Movie TV is a variation of pay-as-you-see. Instead of sitting in your own living-room to see special telecasts you see them in your local movie theatre. The idea has been tried in a few theatres around the country. Telecasts of championship boxing bouts were successful, but a metropolitan opera telecast from the stage of the Metropolitn Opera House produced only so-so results.

Don't expect movie TV in your neighborhood theatres this year, or even a year from now. It's expensive to instal. Technically it needs improvement. And, again, there is a serious legal question as to whether television channels can be used exclusively by the theatres.

AND FINALLY COLOR?

Color TV is a matter of "now you see it, now you don't". Almost three years ago color telecasts were authorised by the FCC. In a couple of communities you could actually go into a store and buy a color set. Then along came materials shortages, and color television was put on ice.

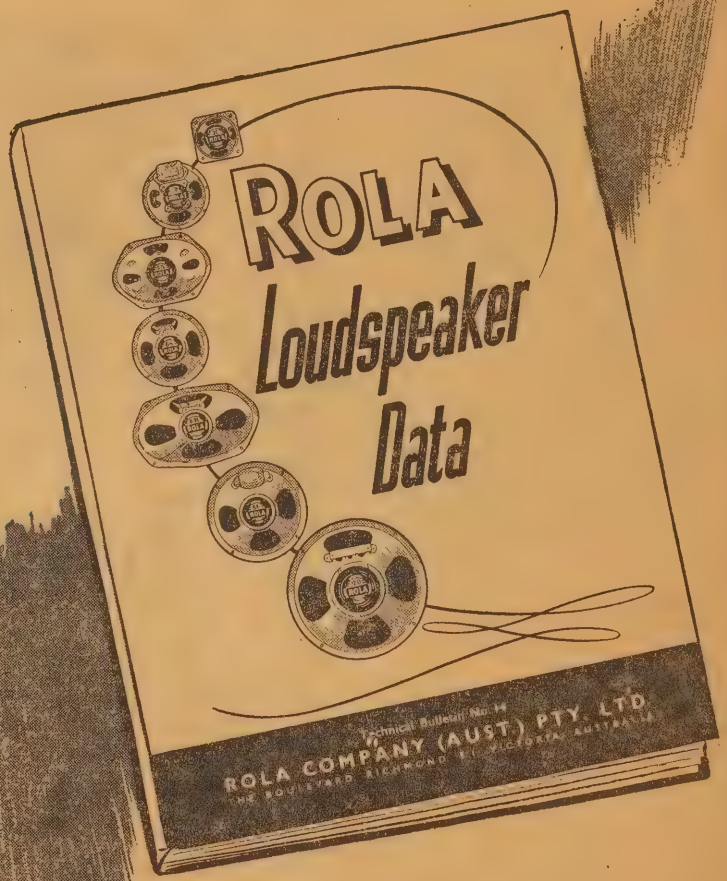
The fact is that there are at least three color systems which are claimed to be commercially feasible. The fact also is that nothing is being done to make them available any time soon.

What does all this mean to you? Just this: Don't believe everything you hear about TV. Take those big promises with a grain of salt. Remember that every youngster has a few blown-up ideas about his future that have to be deflated as time goes on. TV is no exception.

Large RCA Picture Tube in the Making

In making a picture tube for a television receiver, the kinescope is whirled rapidly while a graphite coating is applied to the inside of the glass neck and metal cone at the RCA plant, Lancaster, Penn.

Just off the Press!



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NEW PRODUCTS FROM CRUDE OIL

Crude oil is a hotch-potch of hydrocarbons which are mainly long chains of carbon atoms surrounded by hydrogen atoms. It is now possible to "crack" these chains into links, at the same time releasing a mixture of hydrocarbon gases, most of which are far too valuable to be burnt.

THE establishment of a petroleum chemicals industry in Britain was delayed by World War II, and postwar plans first came into operation in 1949 when the large Shell plant at Stanlow, in Northern England, began the production of a wide range of organic solvents.

Shortly afterwards Petrochemicals Limited, of Manchester, entered the field, to be followed by British Petroleum Chemicals Limited (a joint subsidiary of the Distillers Company, Limited and the Anglo-Iranian Oil Company, Limited) and by Imperial Chemical Industries whose Wilton plant in Lancashire is now working on a large and steadily increasing scale.

MANY PRODUCTS

These four concerns are producing much the same primary products by cracking in one way or another, the long hydrocarbon chains in crude oil fractions. There are the olefines, such as ethylene, propylene, and butylene; and there are the paraffins such as methane, ethane, propane, and butane.

In some cases, those paraffins not required by the producer industry are augmenting the gas supply of the towns near the cracking plant which produces them.

So much for the raw materials; but what is made from them? Ethylene glycol is available from two of the four plants, and a great deal of it is used as anti-freeze mixture for motor vehicles and aircraft. Some glycol is treated chemically to become glycol-ethers and glycol-esters which are important to the leather and surface coating industries.

Imperial Chemical Industries Limited uses ethylene to make polythene which is a widely used plastic developed by Britain during the war. The firm's glycol is one component of terylene which is spun into cloths of every variety. Terylene is now coming on to the market at an increasing rate. Its many virtues including exceptional softness of texture combined with considerable toughness, guarantee it a position at the head of the world's synthetic fabrics.

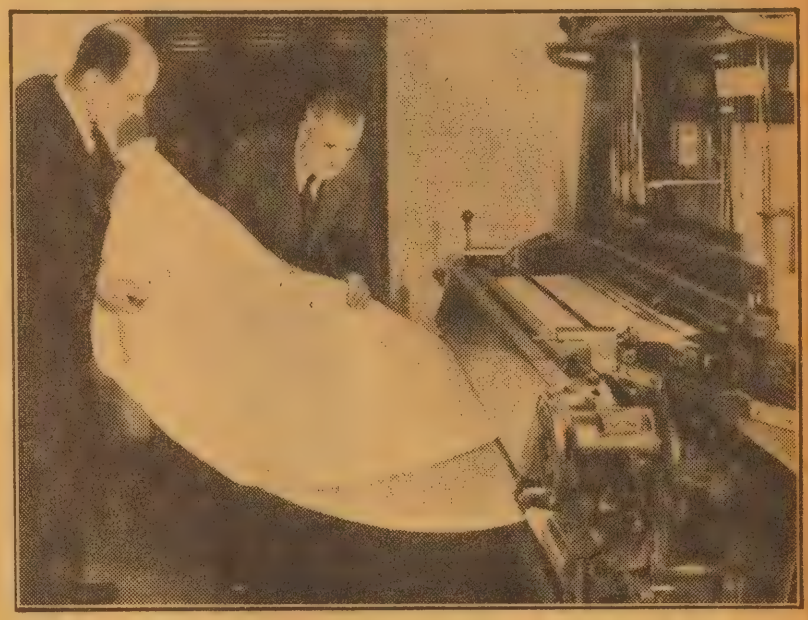
AROMATIC CHEMICALS

The British Petroleum Chemicals plant makes ethyl alcohol from ethylene. Not so long ago, ethylene was produced in quantity from ethyl alcohol obtained from fermentation.

The Petrochemicals plant uses the catarole process to turn out aromatic hydrocarbons which contain not chains but rings of carbon atoms.

Foremost in the group is benzene, with so many uses that one cannot attempt to describe them all. DDT (dichloro-diphenyl-trichlorethane) is but one example of benzene by-products. Toluene can become anything from saccharin to high explosive.

Naphthalene, another of the hydrocarbons, is oxidised to phthalic anhydride, an important ingredient in plastics manufacture.



A sample of terylene cloth coming off the loom at an Imperial Chemicals Ltd. factory in Yorkshire, England. Terylene, made from oil by-products, has many exceptional qualities, not the least of which are extreme softness of texture combined with toughness.

All four producers convert propylene to isopropyl alcohol, which is the main source of acetone, used in the production of artificial silk, plastics, solvents and paints. With the rise of petroleum chemicals came the legion of detergents which have been described as "more soapy than soap".

In six years United Kingdom detergents consumption has doubled to reach 32,000 tons a year of active materials, equivalent to about 28 pc of the world detergent market.

But these multitudinous products are not only dependent on petroleum for their existence. They have been obtainable in quantity from other sources for years. Coal tar, molasses, and to some extent calcium carbide have long been the main raw materials of the heavy organic chemical manufacturers.

Germanium, which is derived from soot, is a comparative newcomer but has already established itself in one field of electronics.

The economic factors surrounding this industry are complex. The two original raw materials, coal-tar and molasses are by-products; the one of coke production, the other of sugar refining.

So long as the main industries continue these materials will be available comparatively cheaply; but while price will determine the choice of material the industrialist must weigh such factors as coal supply and the variations in the sugarcane harvest.

Moreover, although petroleum chemicals save dollars, the crude oil must be imported; but the amount required in Britain as a raw material is only a fraction of her requirements for fuel.

In 1949 it was estimated that a five-year development of a petroleum chemical industry would involve a capital expenditure of £30/35-million. It is highly probable that rising costs will bring the figure nearer to £45-million. When all these plants are in full production they should meet the demands of other industries and, in many cases, provide a supply for export.

A transistor transmitter on the 146-Mc amateur band, operated by George M Rose of K2AH, Mountain Lakes, N.J., worked three stations—the farthest over 25 miles away—with power supplied only by a tiny 22½-volt hearing-aid battery. According to Mr. Rose, who manages the advanced development group at RCA's transistor laboratory, the entire transmitter, including the quartz frequency-control crystal, takes up no more space than a packet of cigarettes. Transmissions were reported strong and clear, even at W2UK in New Brunswick, N.J., more than 25 miles from Mountain Lakes.

A close up view of the tiny automatic transmitter which is sent aloft suspended from radio-sonde balloons. The balloon bursts in the upper atmosphere and acts as a parachute to lower the equipment safely back to earth.

FINDING HOW THE WIND BLOWS

Most married men have occasion at various times to ascertain "which way the wind blows". One popular method after a late night, is to throw the hat in first. If it comes out again you may as well "throw in the towel". Nowadays scientists, whether married or not, are more interested than ever in the above question.

by Calvin Walters

UPPER air research has been stimulated in recent years by the increasing altitudes which are attained by modern aircraft—especially jet aircraft—which fly at heights of 30 to 40 thousand feet or more.

When aeroplanes flew at a ceiling of just a few thousand feet it was quite possible for the meteorologist to forecast with a fair degree of accuracy just what kind of conditions were to be expected. The wind velocities on the ground bore a relationship to the air at five or ten thousand feet so that such forecasting was comparatively easy.

During the war, however, when bombers began to fly at heights of 20 to 30 thousand feet, many contradictory winds were encountered, which were sufficient to upset the calculations of the forecasters.

It is not an easy matter to investigate the upper air conditions. We live at the bottom of a vast ocean of air whose movements are regulated by varying factors. The two main ones are the revolution of the earth on its axis and the inequalities in the heating of the atmosphere brought about by the varying temperatures between the poles and the equator.

The winds which dominate the earth's surface fall into a few main groups. For instance, between 30 degrees north and 30 degrees south latitude, the "trade winds" are dominant. If you glance at a map it will be seen that, between these latitudes, lies half the surface of the earth. The "Trades" blow toward the equator and are so called because they always blow in the same direction, forming a shipping lane. The old meaning of the word "trade" was a path or a beaten track.

The rest of the earth's surface is enveloped in chiefly westerly winds. At the poles the winds also tend toward the equator.

The trade winds blow toward the equator where the almost perpendicular rays of the sun heat the air and cause it to expand and rise. In rising, its place is taken by cooler winds, which blow in from the poles, while the ascending air is drawn toward the poles and thus completes the circulation.

It is obvious that the return poleward winds which complete the circulation must be confined mainly to the higher atmosphere. Their investigation is, therefore, most important for the reasons previously outlined.

Of course the winds as mentioned above do not blow in true south, north, east and west directions as they would in the absence of the earth's rotation. This rotation has a considerable effect in the direction of flow for the reason that the earth's surface drags the air along with it by friction. Thus a wind which blows from the north at the North Pole will tend to blow from the north-west at the equator or from the south-west in the southern hemisphere.

The air which rises at the equator commences to flow toward the poles in each direction. Thus an easterly tendency is imparted to them by means of the easterly rotation of the earth at the point where they started. These upper air winds thus come back to earth at points more easterly than those of their origin, and so they settle to earth, as prevailing westerlies of the midle latitudes.

RADIO BALLOONS

However, recent research indicates that this is not all the story, as it appears that the upper air circulation is somewhat more complex.

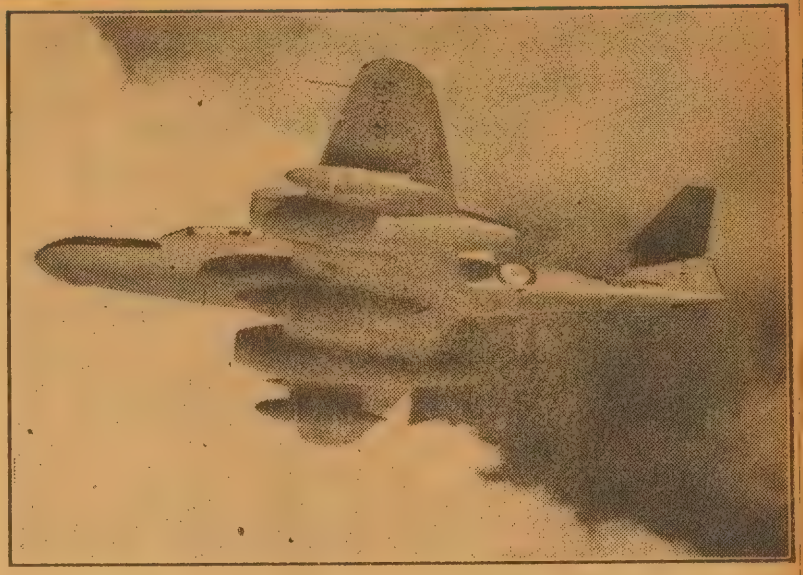
The usual method of upper air investigation is by means of what is called the "balloon sonde". This is a

rubber balloon which, when fully distended with hydrogen, is about three feet in diameter. To this balloon is attached a spider made of bamboo to which various instruments are fastened. These are encased in a special cylinder for protection. The bamboo spider is for the purpose of breaking the fall of the instruments on their return to the ground.

When the balloon has reached a certain height the continual expansion of the enclosed gas with altitude finally bursts the balloon, which then acts as a form of parachute and the whole affair returns to earth. A note is attached to the cylinder asking the finder to return it to the address given. It is rare that the instruments are damaged or not returned, unless the baloon falls into the sea or some unexplored jungle.

The instruments enclosed in the cylinder are of the self-recording type, which trace a curved line on a plate. These records give figures which enable the meteorologist to determine height, atmospheric pressure, temperature, velocity and so on.

While these balloons are a valuable asset for ground observation it is only by direct observation from high flying planes that more accurate information is obtained.



The deadly "Meteor" NF11 night flier which is specially equipped to fly at very high altitudes. High-flying jets are especially concerned with wind currents which are now the basis of special investigation.

ZERO GROUND SPEED

It was during the second world war that some spectacular phenomena were discovered in the upper atmosphere.

American bombers on their way to blast Japan reported that on some flights at a height of 20 to 30 thousand feet their planes were to all intents and purposes standing still — their ground speed was zero. Conversely after they had dropped their bombs and turned toward home their ground speed was twice what it should have been as shown on their instruments.

At first these reports were discounted but they came with such regularity that meteorologists decided to do something about it. Upper air research there and in other parts of the world then disclosed that at heights of approximately 30,000ft there were winds constantly blowing in one direction at a speed of 200 to 300 miles per hour.

These streams of air have since become known as jet streams. It appears that at heights varying from 10,000 to 30,000 ft there are narrow currents of air moving at these high speeds for distances of thousands of miles. They are not, as at first supposed, a spasmodic trick of nature but are always present, though they vary a little from time to time according to the time of the year.

The jet streams reach their highest speeds at heights of 30 to 40,000ft and move in a westerly direction.

WESTERLY WINDS

As explained above, the wind pattern at the surface of the earth is well known. There are the north east trade winds blowing from about 30 deg lattitude toward the equator. Then there are the westerly winds between 30 deg lattitude and 60 deg lattitude. Between the pole and 60 deg lattitude there are easterly winds.

However, the winds at higher altitudes are of quite a different pattern. Here the winds are almost entirely from the west. They increase in speed as we move down from the pole and reach their greatest velocity at about 30 deg north latitude. From there to the equator they lose their high velocity until their direction changes to the east at the equator.

Strangely enough, at the point of highest speed — 30 deg north — they coincide with the point of lowest speed at the surface of the earth. These are the well known horse latitudes.

The area of the strongest winds contains the jet streams. It has been observed that these winds on an average are strongest at heights of 40,000ft all the year round. Whatever season of the year it may be the jet streams are always found just below the stratosphere.

The seasons however have an effect on the position of the streams. For instance in winter they are found at about 25 deg north latitude and in summer at about 45 deg north. In summer they attain a speed of about half that of the winter streams.

Most of the data so far collected relates to the northern hemisphere but from certain research carried out in the southern hemisphere it would appear that similar conditions exist there.

If the behavior of these streams is constant they would furnish a valuable aid to air navigation because

Old time "salts" relied on the seasonal trade winds and their observation of clouds and weather trends. High altitude air streams do not follow the pattern of those nearer the earth's surface.

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they could be exploited by the pilot to assist flight and economise in fuel consumption &c. So far this is not possible because of the vagaries of the streams.

For instance, there is a considerable variation in the speed of the jet along its length. This may vary from 100 miles per hour at some places to 300 or 400 miles per hour at others.

It is not always possible for a plane to fly along the course of a jet. Sometimes it would be necessary to fly across it and here we find great variations.

SPEED VARIATIONS

A Finnish meteorologist has found that vertically through the jet and across it there are very sudden changes in the speed of the wind. While flying across the jet it is possible to encounter a change of 100 mph in a distance of 100 to 150 miles. Similarly a change in speed of 100 mph while ascending from 20,000 to 30,000ft is quite possible.

The jet itself consists of narrow channels of high wind separated by channels of weaker wind.

It would seem that the jet streams are responsible for changes in weather conditions on the earth, for it has been noticed that some very unseasonable weather on the earth's surface coincides with abnormal conditions of the upper air winds of the jet streams.

Throughout the course of the stream great variations of temperature can occur. From an altitude of 10,000ft to 40,000ft the temperature may change from exceedingly warm to abnormally cold.

There appears to be no exact explanation of the jet stream as yet.

Two theories have been advanced. One states that the jet stream results always in the middle latitudes by reason of an extensive mixing process of cyclones and anti-cyclones. As these cyclones and anti-cyclones are more active in these latitudes and not in tropical and sub tropical latitudes, a boundary is established to the zone where this large scale mixing process occurs.

It can be shown mathematically that, at this boundary, the speed of the westerly winds must be at a maximum and this is the point where the jet stream occurs.

TEMPERATURE EFFECTS

Another theory suggests that at great heights warm tropical air and cold polar air are brought in close proximity to each other. When this occurs great pressure differences are set up which result in a circulation of air at great speed.

If the jet stream were properly understood so that its behavior at any given time could be accurately forecast, it would be a phenomenon of very great usefulness to aviation and also the weather forecaster. With the ever-increasing altitude which modern aircraft attain it is of the greatest importance that conditions of the atmosphere be known at heights of up to at least 50,000ft.

Jet planes at present have a range more limited by the fuel supply than the ordinary petrol driven plane. It may be that high head or tail winds could have a tremendous influence on the range of the plane.

How useful it would be if a pilot knew exactly where to find a jet stream moving in the direction of his flight. Riding a stream of air travelling at 200 or 300 mph for thousands of miles would extend the cruising range enormously. On the other hand if he knew just where a jet stream was he would also be able to avoid it if he must fly against it.

Unfortunately the jet stream is very narrow and it is only possible to detect its presence by a consistent system of soundings which is not at present possible except to a very limited extent.

Even having found the jet stream its sometimes violent and unpredictable behavior makes it at present a somewhat hazardous aid to flight.

Within the stream are areas where violent turbulence occurs and some airmen have reported that while riding the stream the plane has been subjected to sudden violent sharp blows as if from a hammer.

These areas of sudden turbulence may be from 50 to 100 miles wide and extend upward for 3000 to 4000ft. To get out of them the pilot must ascend or descend or fly across the stream.

It has been found that rainfall is more pronounced underneath a jet. Latest research indicates that a jet stream may have something to do with the origin of a cyclone and if this is so it will be of great use to weather forecasters.

The weather systems of the world move from west to east with an area of high pressure followed by an area of low. It is thought that the jet stream directs this movement and that the vast masses of air which bring us our variations of warm and cold weather are steered across the continent under the influence of the jet streams.

Those periods of abnormal weather which sometimes strike us bringing floods and droughts and heat waves may also originate in the jet streams and under the influence of solar radiation with variations brought about by sun spots, can cause all kinds of abnormal conditions.

When the origin of the jet stream is discovered and its vagaries can be forecast we may be nearer the day of accurate long range forecasting.

NEW PENNY-SIZE MICROPHONE

During an exhibition of British Radio Components, held recently in London, over one hundred manufacturers displayed new developments in every aspect of sound and vision radio engineering. Amongst the new equipment shown by Tannoy Products Ltd., was this pencil-slim Tube microphone, the head of which, as demonstrated by Miss Sheila Marston, is no larger than a penny. The user is therefore not masked by the head, and there is no cable visible, as this is carried within the stand, which is blended, with the head, into one entity. The total weight of head, stand and cable is 9 pounds. Tannoy are responsible for the sound installations in such buildings as the House of Lords and the House of Commons, London, and those of the United Nations Organisations in Paris and New York.

Filling a long felt want —

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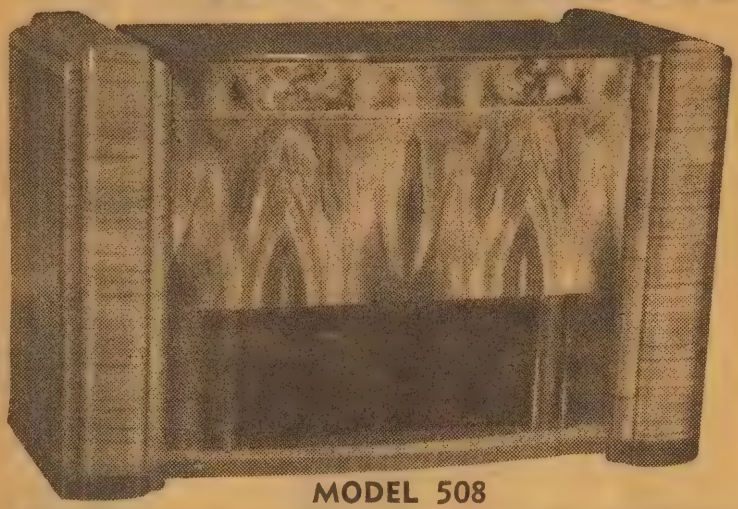

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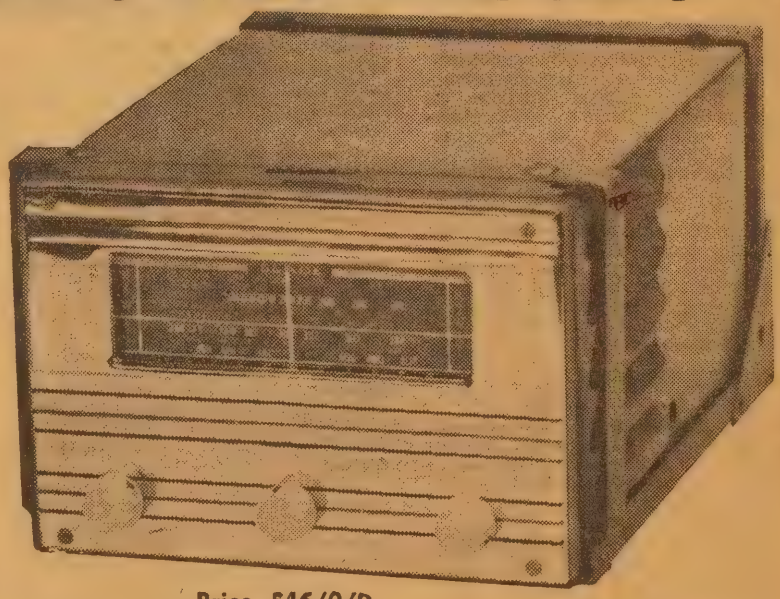

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Technical Review

TV PRINCIPLES FOR MOTION PICTURE PRODUCTION

In a recent article in Wireless World, T. C. Macnamara stresses the possibility of using television equipment and techniques for the production of theatre-release movies. He maintains that a great saving in time and expenditure would be possible.

The use of an intermediate electronic process in the production of motion picture film is an idea which has intrigued technicians for some years.

The major attraction is that it would confer upon the film maker the ability to produce a motion picture in precisely the same way as a television broadcast program is produced, by substituting a motion picture camera (photographing a cathode-ray screen) for the radio transmitter.

The camera would faithfully record on film an entire production, complete with all cuts, fades, wipes, titles, &c., in full continuity in the actual time taken to enact the performance.

The resultant film would, in theory, be capable, after printing and development, of projection as a finished product without cutting or further editing.

Doubtless in practice, this ideal would be difficult, though not impossible, to achieve in its entirety, but the sponsors of this system of production are confident that by its use films can be produced in a much shorter time than by orthodox methods using optical cameras.

TYPICAL SET-UP

The general arrangement of the apparatus used in the proposed process is shown in the diagram overleaf. Electronic cameras are substituted for optical cameras on the studio floor and the pictures emanating from them displayed at a control point simultaneously on a number of viewing units.

At the control point, the director can, by means of instantaneously-acting controls, select, cut, mix or superimpose any of the available shots, and judge the finished result on a master viewing screen. In parallel with this master viewing tube, but elsewhere in the building, is a monitor c.r.t from which the photographed image is recorded.

Continuous recording can be achieved by the provision of two motion-picture cameras operated in relays with a small overlap.

The use of multiple optical cameras, in orthodox film-making, has been regarded by most film technicians as artistically too hazardous. The value and composition of a picture and the effectiveness or otherwise of the lighting can only be judged by the operator who sees the scene through his camera's eye by looking into the viewfinder.

The director, for his part, is working blind the whole time and must rely on his skill and judgment and the advice of his cameraman to form a mental picture of the scene as it will be recorded.

He knows, moreover, that he will not be able to see the result of his work until the next day when the "rushes" are developed and printed, by which time it will be difficult and expensive to retake scenes.

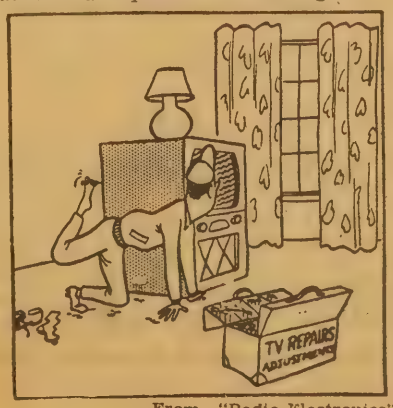
It is natural, therefore, that both director and cameraman should feel impelled to embark on a lengthy series of retakes until each is satisfied that there is sufficient satisfactory material in the "can" to render it virtually certain that a good sequence can be extracted from it.

REASON FOR COST

This and the elaborate cutting process that naturally follows are two of the main reasons why the production of motion pictures is such a protracted and costly business.

If electronic cameras are used, however, an entirely different state of affairs supervenes.

First, the electronic camera can be made smaller and lighter than its optical counterpart. It is more sensitive and hence needs less lighting intensity; it is noiseless in operation and requires no reloading.



—From "Radio-Electronics"

These, however, are incidental gains and the real advantage reposes in the fact that the director can see on individual screens before him the simultaneous picture output of one, two, three or more cameras and can mix, fade or cut them at will.

By directing his camera operators through headphones he can secure exactly the effect he desires on the master screen, with the full knowledge that what he is seeing is being photographed by a motion picture camera from the screen of another c.r.t.

Minor defects in lighting can be corrected while actually observing the result of the adjustment on the screen. Because of this, the number of retakes can be reduced to an absolute minimum.

REHEARSAL

In addition, the facilities provided by the electronic process may be fully exploited during rehearsal when cameras can be used and a large part of the work normally carried out in the cutting-room or laboratory subsequent to taking can be worked out and scripted during rehearsal, thus ensuring that the actual shooting will proceed smoothly and rapidly.

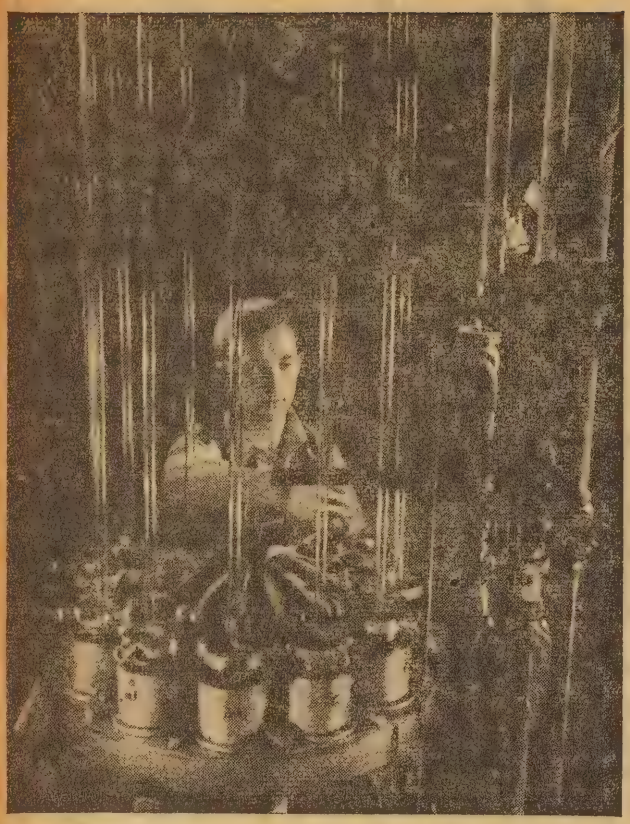
Exterior shots taken with normal optical cameras can be inserted in their proper context during studio shooting by means of film scanning apparatus.

Because the actual cinematography is from the screen of a cathode-ray tube, several negatives may be simultaneously produced by operating a number of tubes in parallel.

For example, both a 35-mm and a 16-mm negative can be produced simultaneously, and to these can be added a 16-mm direct positive, made by reversing the picture electrically and photographing the negative image on the c.r.t. screen.

This direct positive can be "hot-processed" and, in less than a minute after production, can be televised back on to the director's master screen for his scrutiny, or, alternatively, projected for the enlightenment of the artists.

Finally, an advanced stage has been reached in the development of artificial scenic devices including various inlay and overlay processes. By these methods all types of glass shots, back



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This high-speed automatic machine cuts standard "sticks" of glass tubing (1/500th inch wall thickness tolerance) into the lengths required for miniature valve bulbs.

At the Mullard Glass Plant at Blackburn, Lancashire, the common raw materials, silica (sand), soda ash, potash and red lead are converted into literally miles of glass tubing and millions of glass components for the various valve production units of the Mullard organisation. Glass! This relatively cheap, basic material encases the highly developed "gems" of the electronic art—Valves and Electron Tubes.

The photograph on this page is reproduced from the cover of the Mullard Valve Technical Data Handbook—a Catalogue of Mullard Radio Receiving Valves and Special Electron Tubes.

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MR2-53

projection and travelling matte shots may be effected electronically during the actual shooting and without subsequent optical work in the laboratory.

It is obvious that, to be an acceptable substitute for orthodox direct photographic methods, the electronic film-making process must be indistinguishable in quality from the result obtained by normal processes. To achieve the requisite standard of quality poses severe but not insoluble problems.

When considering the problems of generating television images, it is extremely difficult to think in terms other than those of television broadcasting where many factors, both economic and practical have to be studied.

On the other hand, the electronic process for film production described is subject to no such limitations. Working on a closed-circuit system and operated under laboratory conditions, there are no limitations to the bandwidth which may be used, there is no radio link, no long cable and no television receiver.

NO LIMITATIONS

Instead, any standard of definition that appears desirable and any signal waveform that may be convenient can be used. There is no necessity to mix in synchronising information to form a composite signal.

As regards the actual standards of definition required to produce by electronic means a picture on film which is indistinguishable from one taken by normal cinematography, opinions differ over very wide limits.

The author considers that a 1000-line picture with depth of modulations maintained right up to cut-off frequency might be sufficient for the purpose in hand.

The production of such a picture does not present any very serious difficulties, as electronic systems capable of resolving 1500 to 1800 lines are a demonstrable possibility today.

Any desired range of contrast can be realised with complete freedom from the crushing of any part of the tonal characteristic. In fact, compensation can be introduced to straighten the far from linear overall transfer characteristic of the photographic processes from master negative to release print.

For this reason, more faithful results can, in theory, and indeed in practice, be achieved, once the immensely flexible electronic link has been introduced into the picture.

It has been suggested that electronic film-making can do for the motion picture what electronic recording has done for the sound disc, a view with which the author confidently concurs.

Prior to the development of high-definition electronic methods of film-making, the cost of making pre-filmed programs for television by orthodox optical camera methods has been too high for wide use, even if the utmost despatch in studio production is achieved.

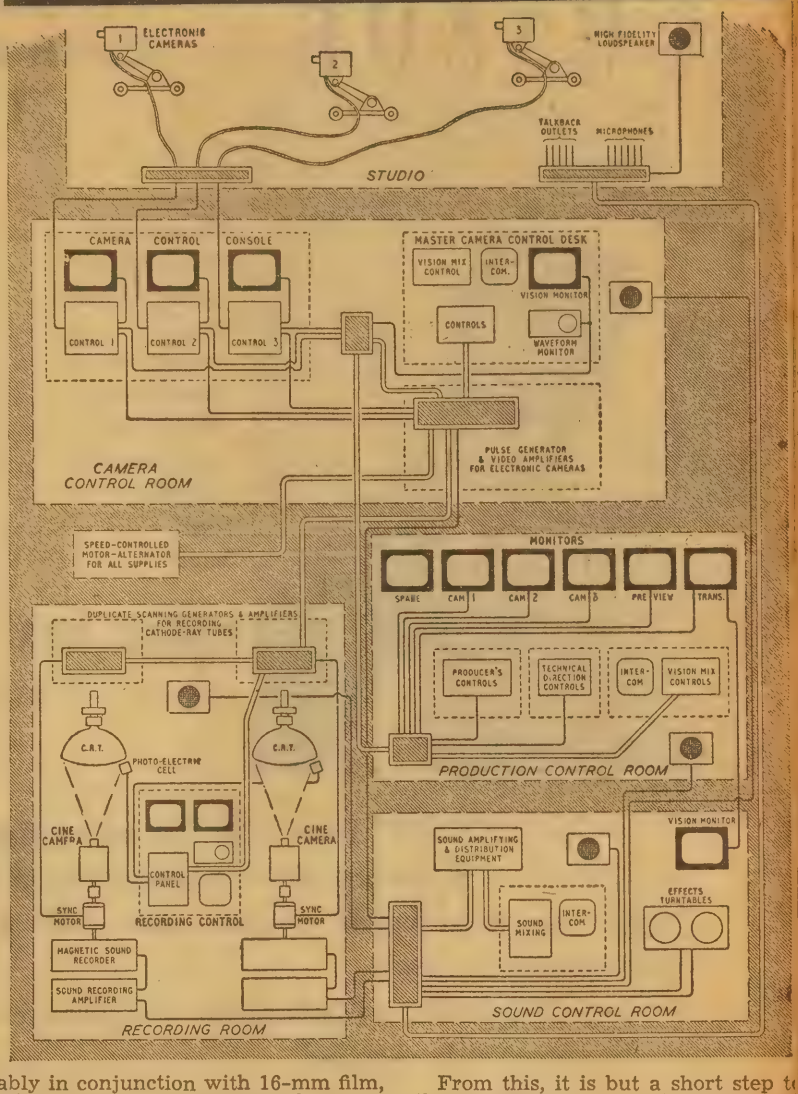
It is firmly believed, however, that the use of electronic methods, probably in conjunction with 16-mm film, will enable programs to be pre-filmed at a sufficiently economic cost and with a standard of technical quality to satisfy the most critical observer.

In this way, the establishment of an exchange of television programs throughout the world becomes practicable; the introduction of sound-tracks in different languages being an already known art should not be difficult.

From this, it is but a short step to the application of the electronic process to films for theatrical release and the extension of the process to color film is not far off.

In conclusion, the author is convinced that in the development of this process, with its manifold applications, a new and tremendously flexible tool is being forged, which will have great potentialities in both the film and television industries.

THE ELECTRONIC FILM SYSTEM



Block schematic of the general arrangement of the equipment used in the system of electronic film-making described by the author. By using a number of c.-r. tubes in parallel several negatives may be produced simultaneously.

Chemical Refining of Metals may lower Production costs

CHEMICAL refining may cut in half the cost of producing metals such as copper, nickel and cobalt. The new process eliminates roasting, smelting, electrolytic and fire refining.

The process has been developed by a number of American chemical organisations.

It consists of pressure leaching, with ammonia or acid, of unroasted sulfide ore concentrates, an almost simultaneous oxidation step, and then direct reduction from aqueous solution of copper, nickel and cobalt as pure metallic powders. Reactions take place in big steel autoclaves lined with acid brick. The autoclaves are agitated.

Process advantages, besides lower production costs, are lower transportation costs, fewer operating personnel and less time lag between production of concentrates and metal recovery. Reduced costs will permit the mining of low grade ores, thus far economically unattractive.

★ ★ ★

A pump with no moving parts handles liquid metals and other low-resistance conducting fluids at temperatures up to 1000 degrees Fahrenheit. Operation is by magnetic force produced by high current set up in the fluid. Capacity is 28 gal. per min. at 20lb per sq. in.

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Heater current	0.6 amps.
Anode Volts	500/800
Max. grid bias	-21/-32 Volts.
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Focus	Automatic
Screen	Green, short persistence

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NEW MAGNETIC SOUND TRACK FOR SILENT FILMS

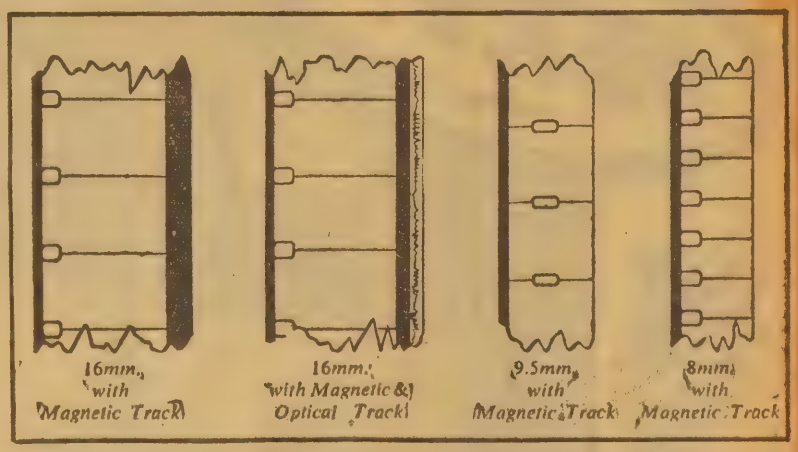
A recently developed process has made it possible to add a fine strip of magnetic coating to sub-standard movie films, allowing a sound track to be provided with the same facility as recording on ordinary magnetic tape. The idea should be of major interest to home movie enthusiasts.

MUCH of the original development work is credited to the "Pyral" organisation in France but processing facilities and suitable equipment are currently advertised in other countries, including England and America.

It is anticipated that magnetic "striping" facilities will become available locally within a few months.

Either old or new films may be treated, the prints simply being run through the striping machine, which deposits a coating of magnetic iron oxide in a position which does not interfere in any way with the picture.

The film is then loaded into a projector, which has been modified beforehand to include a magnetic sound head, similar in function to those provided on conventional tape recorders. This is connected, in turn, to an amplifier and bias oscillator of conventional design.



Illustrating magnetic tracks applied to the three popular sub-standard film sizes. Coatings may likewise be applied to double-sprocketed 16mm. films and also 35mm. films. The cost quoted overseas is a "few shillings per hundred feet".

RECORDING TRACK

The unit is set to "Record" and, while the picture is being projected, the operator can speak a commentary into a microphone or add as many musical excerpts and sound effects as facilities will allow.

All this is recorded on the magnetic track.

Thereafter, the amplifier is operated in the "Play" position and the sound previously recorded is reproduced in exactly the same time relationship to the image as it was recorded. Exact synchronisation is therefore possible.

The sound track is claimed to last as long as the film itself but it may be erased, re-recorded or modified as often as necessary.

Standard procedures have been adopted for all three of the popular sub-standards—8, 9.5 and 16mm.

In the case of 8mm films, the magnetic stripe is added along the edge adjacent to the sprocket holes. Only a very narrow track is possible but, despite this and the slow speed of travel, worthwhile results are claimed.

For 9.5mm film, the stripe is added along one edge, although it is equally possible to have track along both edges if desired.

The convention for both 8 and 9.5 mm films is to coat the base side for reversed films and the emulsion side for contact prints.

POSSIBLE METHODS

Several different approaches are possible with 16mm films. Where the film has a single set of sprocket holes, a broad stripe can be added in the area normally reserved for the optical track. The magnetic recording can be made, as desired, at either the silent or sound speeds.

Films having two rows of sprocket holes may have a track added on either side, or to both sides beyond the position of the sprocket holes. It is thus possible to add sound to any existing print.

As before, the convention is to apply the coating to the base side of reversed films or to the coating side of contact prints.

Where the film already has a sound track, the magnetic coating can obliterate it completely, if no required, or it can be laid as a narrow stripe to cover exactly one half of the optical track.

With either variable density or balanced variable area recording, the optical track can still be reproduced without appreciable increase in distortion and with a loss of level only about 6db.

This facility makes it possible to have different sound tracks on the one film as, for example, a commentary aimed at different classes of audience.

SPECIAL REQUIREMENTS

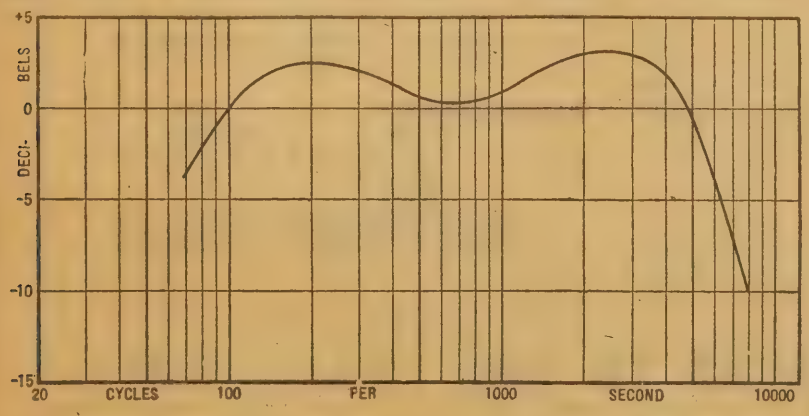
In the same way, different prints of any film can be dubbed easily with different sound tracks to suit a variety of requirements.

Naturally, projectors have to be suitably equipped with a magnetic sound head to play the new type track.

With existing 16mm sound projectors, the addition of the head may not be a very difficult matter since all the necessary speed regulating equipment is in-built.

With silent projectors, however, it would be necessary to add a sound head, possibly between the last sprocket and the take-up spool. This head would mount the necessary fly wheel, additional sprockets and the magnetic head.

It is understood that various manufacturers are giving this problem their attention at the moment anticipating that magnetic tracks will be very popular with owners of "silent" projectors and equipment.



The frequency range claimed for 16mm film. Volume range is quoted as 50db. against 30 db. for an optical track. Harmonic distortion is claimed to be below 3 percent.

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NEWS AND VIEWS OF THE MONTH

Breeding atoms

A NEW process ultimately would multiply the world's nuclear fuel resources more than 100 times, the chairman of the US Atomic Energy Commission (Mr. Dean) said in New York recently.

Mr. Dean described the process as "atom breeding"—a milestone in man's conquest of the atom.

Mr. Dean added that the commission's nuclear reactor-testing station in Idaho had successfully demonstrated the new process.

Future implications are the same as if man had learned to produce from water 100 gallons of petrol for every 100 gallons of petrol he used.

The new process theoretically made possible the production of more atomic fuel (fissionable material) than was consumed.

The commission so far had succeeded in "breeding" atomic fuel at the rate of consumption.

Artificial lung

A MILDURA Base Hospital engineer has invented a "breathing" machine which enables a patient from an iron lung to spend hours in the open.

Called a pulsator, it applies artificial respiration by means of a rubber bladder placed against the body.

One iron-lung polio patient at Mildura Hospital has been able to spend up to five hours in the sunshine.

The inventor of the pulsator is Mr. G. C. Hall, 37.

He is now building a pram to which the machine can be fitted.

The pulsator can be put in a motor car and will run off a car battery.

Dr. P. L. Colville, an officer of the poliomyelitis division of the Health Department, and Mr. J. V. Moore, one of the department's engineers, inspected the pulsator recently.

Dr. Colville said it could not cure a polio patient, but would make life easier and probably help psychologically.

Magnetic dentures

AMONG those subjects not generally discussed at the tea table is the difficulty of making a set of dentures stay in place. To the scientifically-minded, however, no subject is sacred. To him a problem is a problem.

Claimed to represent an important advance in dentistry, "magnetic" dentures are now being widely distributed both in Britain and overseas by a Lancashire firm.

Each set of dentures is fitted with small but extremely powerful magnets of the same polarity.

Because "like" poles of a magnet repel each other, the upper and lower dentures remain firmly in place on the gums.

Thousands of the dentures have already been flown to Ceylon, South America, Egypt, Australia, New Zealand, Switzerland, Sweden, France, Belgium and the Middle East.

Ultrasonics heal

AMONG the many uses of ultrasonic frequencies is included the healing of tissues not responsive to other treatments.

Dr. William Bierman, chief of physical medicine at Mt. Sinai Hospital, in USA, has used the ultrasonic vibrations to treat scarred, disabled hands.

One patient was a boy who had accidentally slashed the palm of his hand deeply and lost the use of the hand.

The ultrasonic wave treatment softened the scarring substance, and now the boy uses his hand normally.

However, ultrasonic waves must be employed only according to strict rule provided by the latest investigations, which are still unknown to most doctors and engineers.

At the Mayo Clinic, Rochester (Minn.), Drs. J. F. Herrick and Justus F. Lehman have investigated effects of ultrasonic vibrations upon the nerves and other body tissues.

The investigations show the temperature of the sound-stricken tissues is raised.

Also there is a mechanical effect upon the vibrated body substances.

The doctors stress that all this is only a beginning in the exploration of the living body with "silent music" waves.

Radioactive sleuths

ENTOMOLOGISTS are planning new uses of radioactive insects and insecticides to find out how far and how fast insects fly, how an insecticide kills an insect, and just how some insects (particularly houseflies and roaches) develop resistance to insecticides.

Since insects do great damage themselves, and often carry diseases of plants, humans and animals, the knowledge of how far they may travel in a known time helps in insect control.

An insect (or insects) "tagged" with one of the radioisotopes can

POPULAR SCIENCE QUIZ

Q. With the present known means of possible outer space travel, what are the chances of surviving a space ship crash?

A. At a recent meeting of the American Rocket Society, Dr. Fritz Haber of the Air Force School of Aviation Medicine, Randolph Field, Texas, reported that one's chance of escape and survival from a space ship mishap was relatively poor.

If the air pressure within the space ship was suddenly lost, say as a result of an explosion, there was every chance of the crew being killed instantly by being sucked through the resulting hole in the ship. Experiments have shown that this would probably be the case and, even if they were wearing pressure suits, they probably would not survive.

On the other hand, if the crew could leave the ship through a decompression chamber, their chance of survival would be brighter provided that they were "fairly close" to the earth where they could be quickly picked up by rescue ships despatched for the purpose.

It would be important that they be "close" to the earth at the time. If they were well out in space, even assuming that they could safely evacuate the ship, their pressure suits would not keep them alive long enough to be rescued, even if they could be found.

If they were too close to the earth, such as in the realm now believed suitable for an earth-orbiting space station, they would be under the continually-increasing gravitational force of the earth as they were being whizzed toward it. In the outer rare atmosphere, their bodies would reach a speed of about four times that of sound until they reached the more dense atmosphere closer in where the tremendous braking action of the air would crush their bodies.

The resulting decelerating force would be of the order of 300 g's, a force far in excess of what the human body can safely withstand. In addition to this, the air friction would result in generation of heat of the order of 36,000 deg Fahrenheit, a temperature which would ignite any material on the outer surface of the body.

Q. At how slow a speed can a conventional aircraft fly?

A. A small private plane produced at Norwood, Mass., USA, for commercial use this year is claimed to be able to fly at 35 mph even with a full load. It is known as the Courier model.

A 260 hp engine powers this all-metal plane and gives it a cruising speed of 150 mph. Leading-edge automatic slats eliminate stalling in slow flight and very large flaps permit landings at very low speed. It is claimed that it can take off and land quite comfortably on a 100yd strip.

The new plane, called the Helioplane, was designed by a staff member of the Massachusetts Institute of Technology in association with a Harvard University professor, both experts in aviation. A military version of the plane has been produced for the US Air Force.

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See the actual photograph above!

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be detected by a counting mechanism, even when out of sight—for example, under the bark of a tree. Similarly a "tagged" insecticide can be traced into an insect's small body to see what physiological changes take place—or perhaps fail to take place—as an insect develops resistance to an insecticide.

Radioactive blowflies released in previous US Department of Agriculture experiments in the west were detected by Geiger counters in traps 20 and 28 miles from the point of release.

Radioisotopes may later be used to find out just how systemic insecticides are distributed in plants. They are being used in studies of how hive-destroying bee diseases spread, and of the complex relations various castes of bees within the hives have to the production of honey.

Self starters for jets

THE problem of a self-starter for turbo-jet engines, the power plant in jet-propelled planes, is approaching solution by developments both in America and England.

In both countries the solution seems to be a tiny rocket-type engine within the plane electrically started by push-button to provide the power to start the main engine into operation.

The self-starters used with piston engines in conventional planes cannot be used for jet engines because of the large amount of power needed. The use of jet-propulsion in aircraft has been held back by the necessity of outside power at airports to put their engines into operation.

With satisfactory self-starters built into them, they will be able to take off from emergency fields in combat and other areas where outside electric power is not available.

Several types of self-starters for jet engines have been developed during the past few years, but few were successful enough to be generally adopted. The newest types use a small jet engine within the plane to start the main power plant. The small jet engine uses a liquid or a solid fuel and operates somewhat like a rocket engine.

The new British type of self-starters is described as a miniature gas-turbine with a combustion chamber, a turbine and a shaft. For fuel it uses a little-known liquid known as propyl-nitrate. When ignited, it produces power to drive the small turbine. This is geared to produce up to 10,000 revolutions per minute on the shaft, sufficient to start the main engine.

The most recently announced American self-starter is a development of Bendix Aviation Corporation, Teterboro, NJ. It is a typewriter-sized 75lb starter, which burns a mixture of high-pressure air and jet fuel. It is already in production and is being installed on Sapphire jet engines, power plant of the new air force F-84-F fighter-bomber.

A self-starter revealed recently by General Electric uses a solid fuel to operate the small jet-engine type of starter.

British officials claim the liquid propyl-nitrate fuel system is better than the solid fuel system, because the latter is limited by the number of cartridges available, while the liquid propellant is limited only by the size of its carrying tank.

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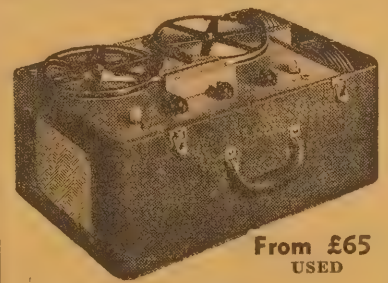

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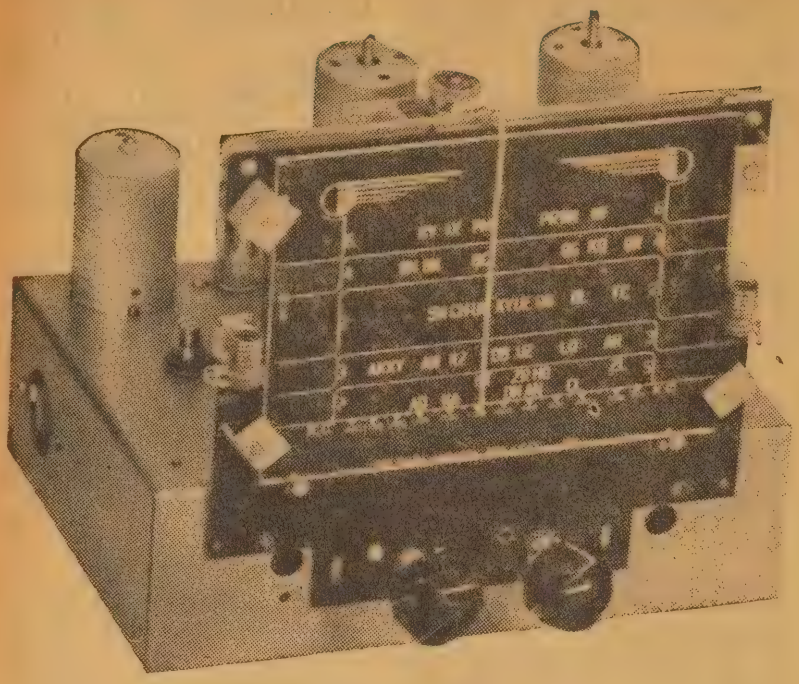


A front view of the tuner. The knob on the left is the tuning control and the one on the right the selectivity switch. The two IF transformers can just be seen behind the dial and the whistle filter coil and the 12AU7 to the left of the dial.

FIDELITY OR DX AS REQUIRED

The original Playmaster Wide Range Tuner described in the August, 1952, issue of Radio and Hobbies was extremely popular and large numbers have been built to the entire satisfaction of their owners. In this article we describe another version of a Wide Range Tuner embodying the additional feature of variable selectivity. It is ideal for the poorer reception areas.

by Philip Watson

ALTHOUGH the original tuner was far superior in its ability to separate stations than a loaded TRF, it was, quite naturally, not as selective as a set using a 455 Kc IF channel and designed essentially to separate stations. It was not surprising, therefore, that just a few enthusiasts were disappointed with results when they tried this tuner in what might be fairly termed "difficult locations".

INTERFERENCE PROBLEMS

In some cases it was found that the tuner performed excellently during daylight hours, having more than sufficient sensitivity to receive any worthwhile stations and being quite able to separate all that were audible. At night, however, this position changed completely. Interstate, and even New Zealand, stations were frequently received almost as loud as the "locals", causing considerable interference unless the wanted signal happened itself to be particularly strong.

While it is true that the stronger signals are generally more suitable for wide-range listening, it is equally true that reception is often required from some weaker station without any particular need for wide-range reproduction.

A somewhat similar situation occurs in more remote districts, where the listener may be served by one regional station providing a primary area and, for the rest, is forced to rely on more distant stations.

It is fairly obvious that it is virtually impossible, at least in a practical sense, to produce a tuner which would satisfy these essentially conflicting requirements with one characteristic, and that the most satisfactory solution is to provide a means of varying the selectivity to suit either condition as required.

This, then, is the background to our latest effort. Before ever we resurrected the band-pass aerial circuit, we appreciated the need for some form of variable selectivity and produced a number of sets in which this was achieved by switching out one of the IF transformers and substituting a resistance-coupled network.

AERIAL CIRCUIT LOSSES

There was no doubt that the scheme did give a worthwhile improvement in bandwidth, and, since it only called for a few additional minor components, it could be looked upon as being almost something for nothing and a very simple way to achieve something better than was normally possible.

After the experiments which led up to the development of the original Wide-Range Tuner, it was realised that widening the bandwidth of the IF channel was not, in itself, a total solution of the problem and that the aerial coil was partly to blame for the loss of the precious sidebands.

Thus, when we were faced with the problem of fidelity enthusiasts in difficult locations, we commenced to wonder whether the old variable selectivity scheme could not be improved by the addition of the band-pass aerial circuit developed for use with 1.9 Mc IF's.

Accordingly we set to with paper and pencil and drafted out a likely circuit to combine these two schemes, then collected the necessary bits and pieces and commenced to turn theory into practice.

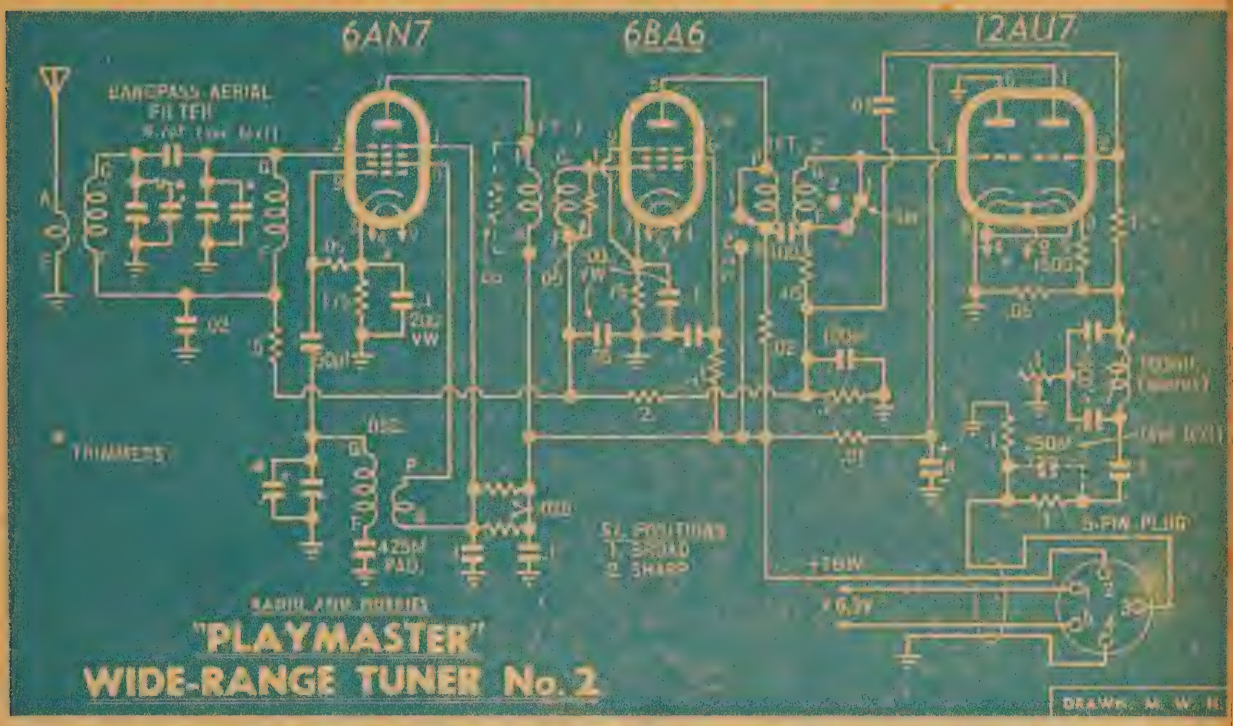
As soon as we had the tuner working and commenced to make some frequency checks, one point was immediately obvious. This was that a 455 Kc IF channel can still be stubbornly selective, even with one transformer out of circuit.

MASKING THE BAND-PASS

So severe can this effect be that it masks the band-pass chacarteristics of the aerial circuit to the point where it is impossible to tell whether this is correctly adjusted and whether it is, in fact, passing a band of frequencies or not. For this reason we found it essential to load the secondary of the first IF with a .05 megohm resistor to make it broad enough to accept the band-pass characteristic.

The ideal solution of the problem

NEW TUNER INCORPORATES SELECTIVITY SWITCH



The circuit is in many ways similar to the original Wide Band Tuner, the main difference being the use of 455 Kc IF's with variable selectivity switching. The .05 meg. "loading" resistor across the primary of the 1st IF is optional, but the one across the secondary is really essential with normal IF transformers.

would be a special IF transformer for this position deliberately designed with a broad characteristic, but unless, or until, such a transformer is forthcoming, the only alternative appears to be the one we have adopted.

Actually, the effect of the loading is not as serious when the tuner is used in the narrow band position as might be imagined, the second IF taking over to good advantage. The nett result is that, even with both primary and secondary windings loaded, the unit is still capable of producing the curve shown in the accompanying graph. What the graph cannot show is that the signal is just on 30 db down at 9Kc. By the time the unwanted signal is past the whistle filter circuit into the region of 11 Kc it will be many more db down from this point.

"BROAD" PERFORMANCE

On the other hand, in the broad position, the response is very close to the ideal, being 2db up at 7 Kc and falling through reference as the whistle filter circuit comes into effect near 10 Kc. It effectively equals the performance of our original Wide-Band Tuner.

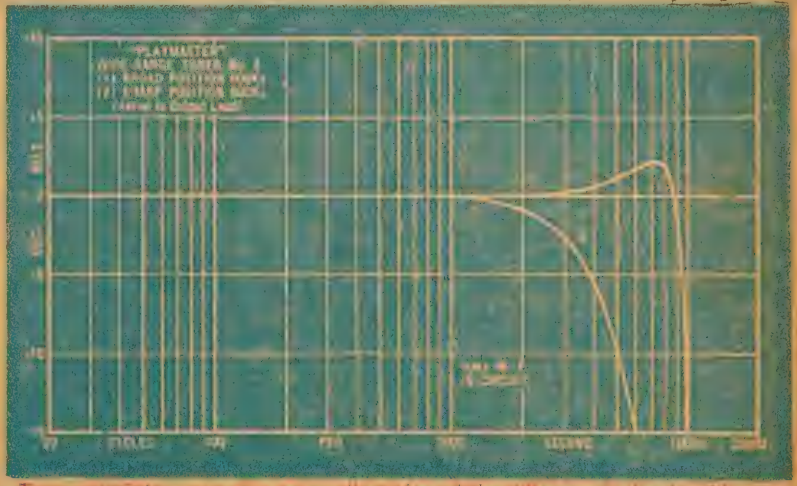
The whistle filter, of course, is now familiar to most readers, but briefly its purpose is to eliminate the 10 Kc heterodyne or "whistle" which is frequently encountered in tuners having a broad response. It is caused by the beating of adjacent carriers, and is always 10 Kc because adjacent carriers are always 10 Kc apart. The whistle filter eliminates this heterodyne by rejecting a narrow band of frequencies, only a few hundred cycles wide, peaking at 10 Kc.

The circuit used is particularly effective and the receiver, for all practical purposes, will not respond to a 10 Kc signal.

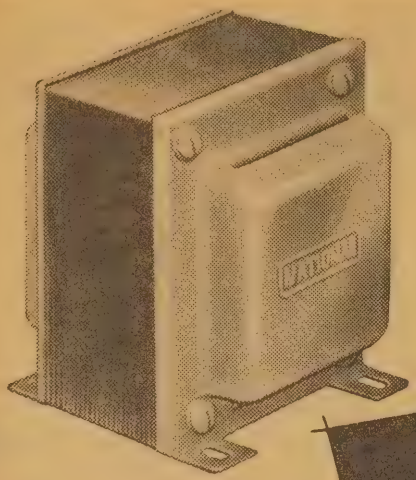
So much then for the general background; now for some specific constructional details.

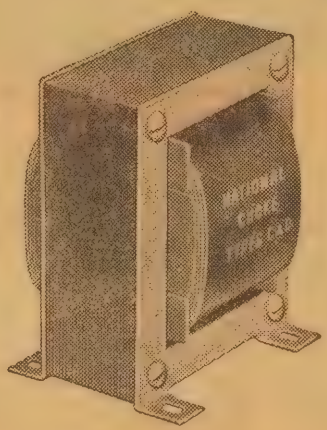
We chose the same chassis and layout as was used for the original Wide-Range Tuner, partly because there did not seem to be much point in altering it, and partly to enable anyone who had built the original to modify it to this design with a minimum of trouble. Thus, where the original has proved inadequate in a difficult locality, it will be only necessary to change the IF transformers and oscillator coil and fit the additional switch and a few minor components. In many cases the coils will already be on hand, so that very little expense will be involved.

In order to eliminate any chance of long leads to the switch introducing instability, we decided to take the switch as close to the points concerned as possible, using an extension shaft and coupling to bring the control to the front of the chassis. We used a ¼in coupling and a length of ¼in brass rod, but it may be possible



These selectivity curves give an excellent idea of the difference in band width given by the two switch positions. Both these curves were taken with loading resistors across both the primary and secondary of the 1st IF. Local conditions will determine whether one or both are desirable.





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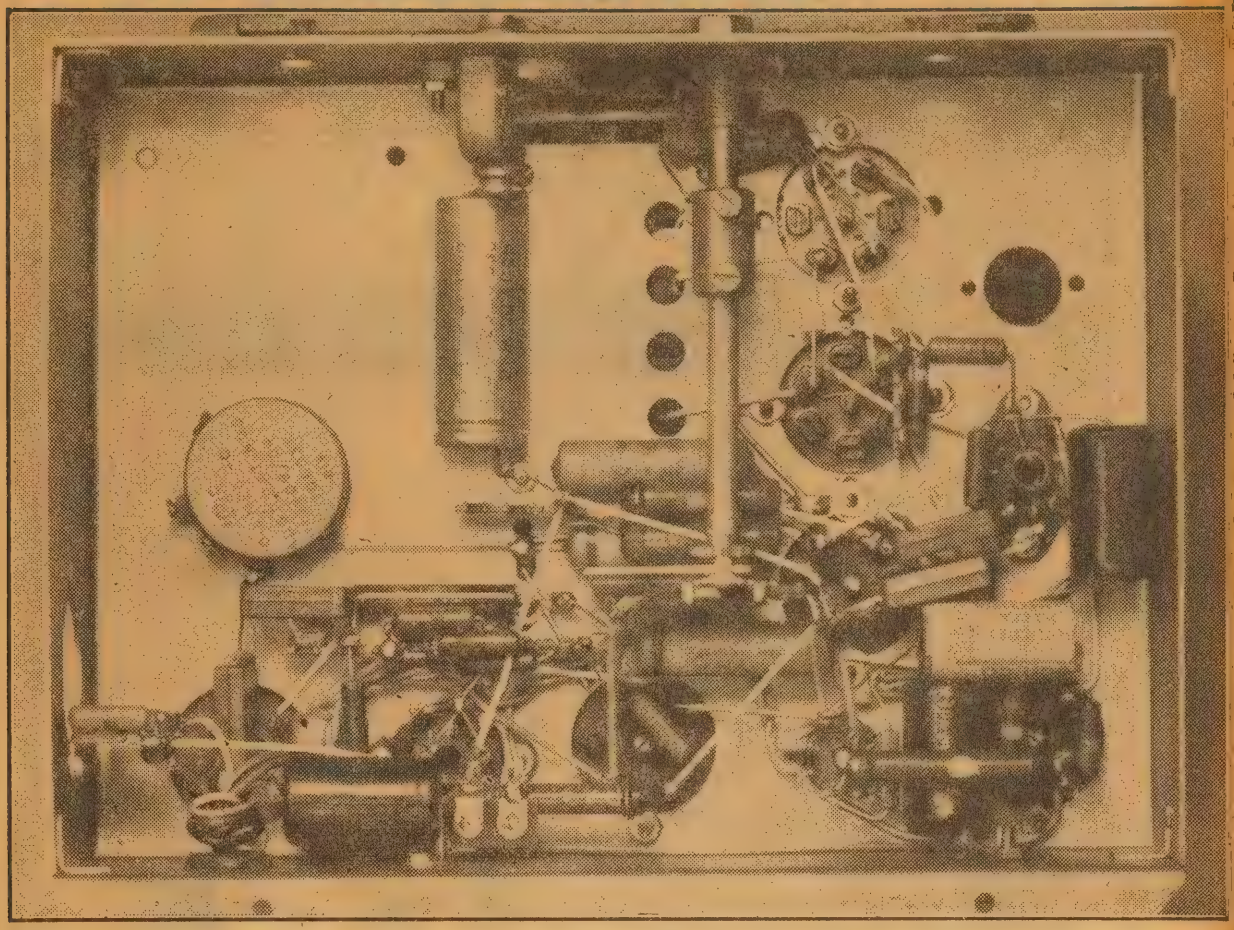
A DETAILED UNDERNEATH VIEW OF THE TUNER



This under chassis shot gives a good idea of the placement of parts. Note the position of the selectivity switch and the extension shaft used with it. The three coils to the right of this shaft are the two band pass and the oscillator, the latter being nearest the switch. Along the rear of the chassis are the two IF transformers and the whistle filter coil. The .01 meg. decoupling resistor is not shown in this picture.

to obtain an extension shaft which is long enough to do the job.

The switch itself is mounted on a small bracket secured under one of the gang-mounting bolts. To secure it at a second point we drilled a hole through the chassis and gang-mounting foot to take a 1-8in bolt. As can be seen from the photograph, the hole for the switch is near one edge of the bracket, an arrangement made necessary by the presence of the oscillator coil.

FRONT BEARING

Some form of bearing is required at the front of the chassis and we used the bushing salvaged from a discarded potentiometer. Although not a stock item, most home builders should have no diiffculty in producing such an item from the junk box.

In order to accommodate the extra control, it is necessary to locate the tuning shaft to one side rather than the centre, this being simply arranged when the dial is being assembled. When assembling the dial, don't forget to remove the screw which temporarily holds the drum in place. This is not intended to be left in place, and if it is the dial will not run freely.

The coils we used were standard size cans rather than the midget types used for the original tuner, but this is something of an advantage, since the chassis is cut for the larger types. On the other hand, miniature types can be used, if on hand, by the simple procedure of using a metal plate, as was done in the original.

To provide the most satisfactory wiring arrangement, it is important to mount the coils, IF's, and the valve sockets as we did in the original, and the following data should enable this to be done: Aerial coil, pins 1 and 3 (G and F) toward the gang. Band-pass coil, pins 1 and 6 (G and B) toward the gang. Oscillator coil, 6 and 4 (Band P) toward the gang.

Resistor Color Code

Resistor	Body	Tip	Dot
2 Meg	Red	Black	Green
1 Meg	Brown	Black	Green
.5 Meg	Green	Black	Yellow
.2 Meg	Red	Black	Yellow
.1 Meg	Brown	Black	Yellow
.05 Meg	Green	Black	Orange
.025 Meg	Red	Green	Orange
.02 Meg	Red	Black	Orange
1500 ohm	Brown	Green	Red

This arrangement means that the band-pass coil will mount in the chassis holes already provided, but that additional 1-8in clearance holes for the aerial and oscillator will have to be drilled.

Both IF transformers are mounted with their G and B pins toward the rear of the chassis. The 6AN7 socket has the gap between pins toward the oscillator coil, the 6BA6 has the gap toward the first IF, and the 12AU7 has No. 1 toward the second IF.

TAG STRIPS

While most of the smaller components may be mounted directly between terminal points on the larger ones, there are a few which are more conveniently mounted on tag strips. These are the diode circuit resistors, the cathode follower network, part of the AVC network, the HT system, and the voltage dividing output network (where required).

The diode and cathode follower resistors are mounted on a combination of a five and a three tag strip, this providing a more convenient arrangement of earth terminals than a single eight terminal tag strip. These strips may be seen in the photograph just above the 12AU7 socket and to the left of the switch bracket.

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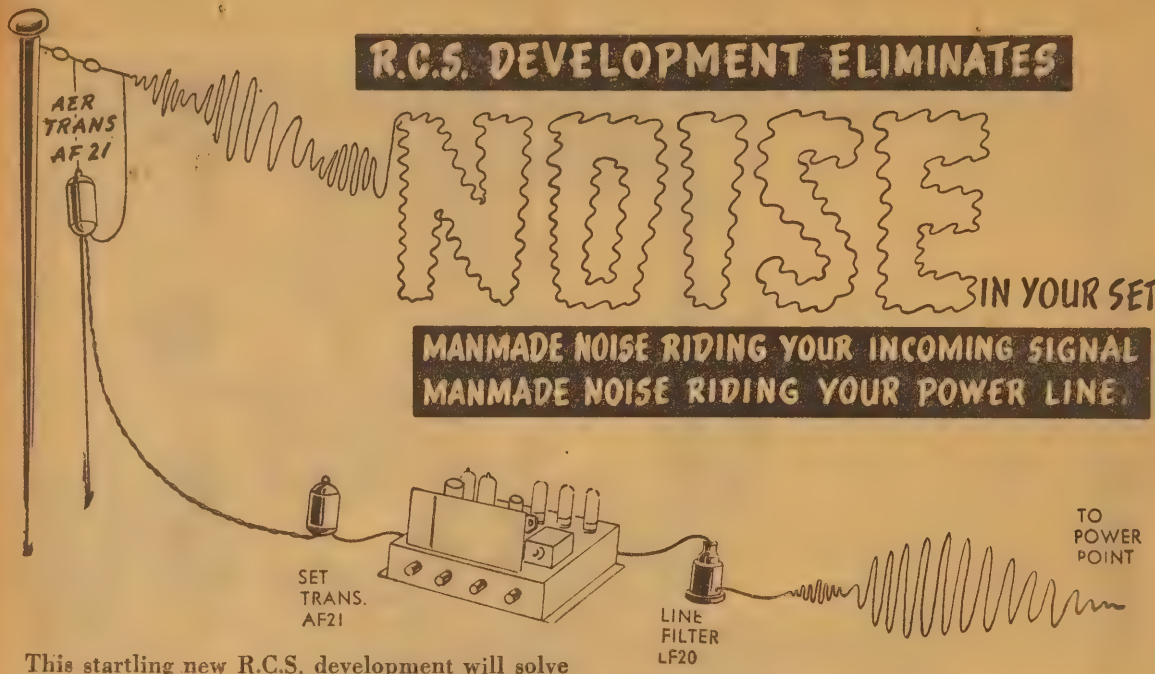

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The output dividing network is mounted on a five terminal strip and is mounted against the edge of the chassis near an unused socket hole. Another five terminal strip is also used to terminate the five-way cable and this is mounted against the rear of the chassis and may be seen in the photograph partly obscuring the 12AU7 socket.

The five connections to the cable are: Heaters, HT, earth and audio.

A small tag strip is used as a HT anchor point near the positive end of the electrolytic capacitor. The negative end of the electrolytic is toward the front of the chassis. The .5 megohm AVC resistor is mounted on a three terminal strip anchored under one of the nuts holding the band-pass coil.

The 100 pf capacitor coupling the B and F terminals of the second IF is most easily fitted to the base pins before the transformer is mounted in place and the angle at which it is mounted may be clearly seen in the photograph.

AERIAL ROUTE

To reduce any possibility of unwanted coupling to the aerial lead this is brought out to the top of the chassis near the aerial coil and taken to the rear of the chassis. Here it passes back through the chassis and connects to the aerial terminal. The total length under the chassis at this point is only a fraction of an inch.

Other leads to watch are those from the second IF to the switch, and these should be made as short as possible without any attempt at fancy angles. They were kept perfectly straight in the original and caused no trouble whatever.

After assembly of the major components and tag strips, but before the main wiring is commenced, the various earth points around the chassis should be bonded together with tinned copper wire of about 16 or 18 gauge. This is particularly desirable where a steel chassis is used, as will generally be the case, because it is difficult to make effective connection to the chassis thorugh the paint. Even if the paint is penetrated there is always the chance that rust will eventually ruin a vital connection and cause instability.

For the remainder the wiring and construction is perfectly straight forward, it only being necessary to observe the usual care in the placing of vital grid and plate leads to ensure that there is no coupling between them which will cause instability.

BAND-PASS ALIGNMENT

When this is completed and the tuner brought to the stage where it is capable of receiving signals attention must be given to the alignment and in particular, to the adjustment of the band-pass circuit. Unless this adjustment is carried out correctly the benefit of the circuit will be largely lost, and the procedure to be adopted should be studied carefully.

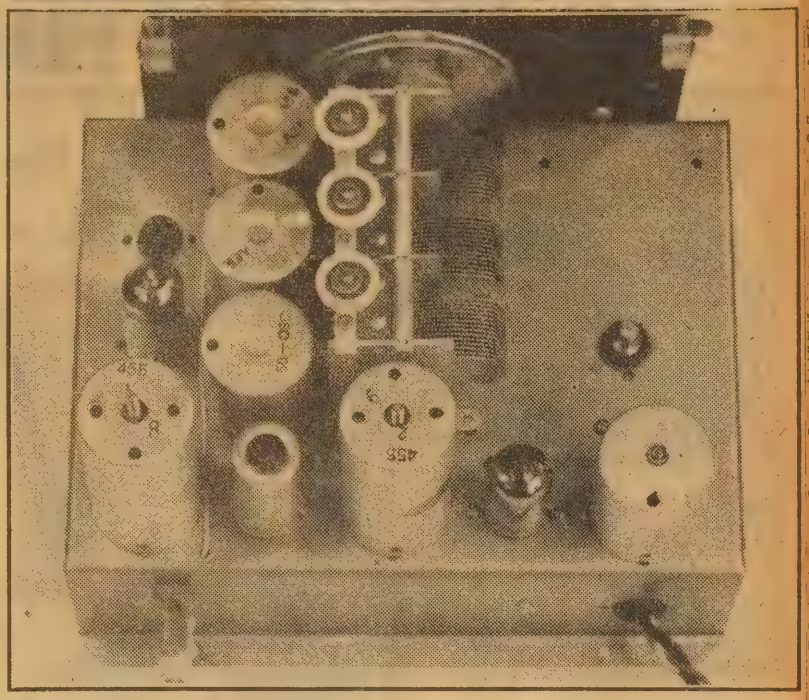
Two values in the band-pass circuit are fairly critical, the common AVC by-pass capacitor and the small top coupling capacitor between the grid ends of the two coils. The AVC bypass is .02 mfd and being a standard value should not present any difficulty. The top coupling capacitor needs to be between 2 and 5 pf, the exact value depending on the design of the coils and the actual band-pass characteristic required.

For our previous tuners we have recommended a home-made capacitor of 2 to 3 mfd consisting of two lengths of plastic hook-up wire (7.010) tightly twisted together for about two inches. In some cases this may still be suitable but we found that for the coils we used and the amount of band width we required we obtained good results with a small ceramic capacitor of 4.7 pf. This provided a double hump band-pass characteristic, the two humps being about 9Kc each side of the main frequency and approximately equal in height.

Before attempting to adjust the band-pass circuit the IF channel should be carefully aligned, with the switch in the sharp position, and then switched to the broad position for the band pass adjustment. It is important that the first IF secondary, at least, be loaded before alignment with a .05 megohm resistor, otherwise it is impossible to observe the band-pass characteristic.

Set the signal generator to 600 Kc and the dial-pointer to the same mark on the dial, then adjust the slug in the oscillator coil until the signal is received at maximum strength. So far the procedure is normal.

LOOKING DOWN ON THE CHASSIS



This top view of the chassis will give the constructor an excellent idea of the placement of the major parts. The three coils alongside the gang are: Aerial, (front of chassis) band pass, and oscillator. 1st IF is in the rear left corner, then the 6BA6, 2nd IF, 12AU7 and whistle filter coil in that order.

LIST OF PARTS

- 1 chassis 8½" x 6¼" x 2½". (Pentagrid 4 and 5. Kits Nos. 2 and 6.)
- 1 3 gang minature tuning capacitor
- 1 dial with glass to suit (USL44 or similar)
- 1 set bandpass aerial filter coils, broadcast (2 coils)
- 1 broadcast oscillator coil to suit 6AN7 for 455 Kc
- 2 455 Kc IF transformers
- 1 10 Kc whistle filter coil (approx. 100 mH)
- 3 trimmer capacitors
- 1 2 pole, two position switch (MSP series 20, type 22 or similar) Approximately 3" of ¼" brass rod
- 1 ¼" to ¼" coupling
- 1 ¼" brass bushing
- 2 miniature 9-pin sockets, 1 7-pin miniature socket with shield, 1 5-pin plug with cover.

VALVES

1 6AN7, 1 6BA6, 1 12AU7.

CAPACITORS

1 8 mfd 450 WV electrolytic, 3 .1 mfd 350 WV, 3 .1 mfd 200 WV, 1 .05 mfd 200 WV, 1 .02 mfd 200 WV, 1 .01 mfd 200 WV, 2 .005 mica, 1 425 pf mica, 2 100 pf mica, 1 50 pf mica, 1 4.7 pf ceramic.

RESISTORS

1 2 meg. ½W, 1 1 meg. ½W, 1 .5 meg. ½W, 1 .2 meg. ½W, 1 .1 meg. 1W, 1 .1 meg. ½W, 1 .1 meg. potentiometer, 1 .05 meg. 1W, 3 .05 meg. ½W, 2 .025 meg. 1W, 1 .02 meg 1W, 1 .01 meg. 1W, 1 1500 ohm ½W 1 175 ohm ½W, 1 75 ohm ½ W.

SUNDRIES

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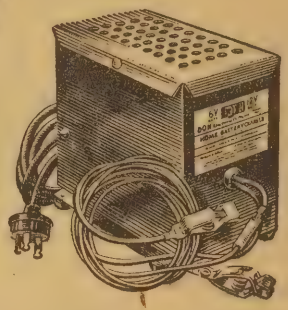

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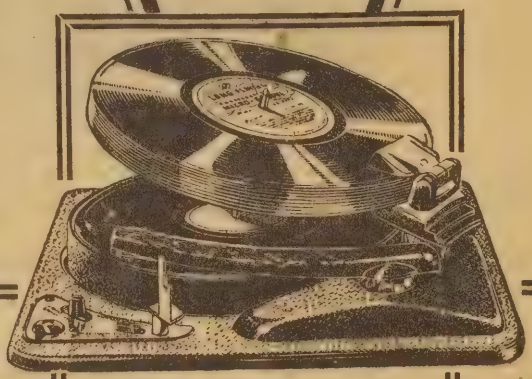

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When this stage has been reached, connect a resistor of between .01 megohm and .02 megohm between chassis and the grid pin of either the aerial coil or the band pass coil. Check the oscillator coil slug once more then, without touching the dial setting, proceed to peak the coil NOT shunted by the resistor.

When peaked, transfer the shunt resistor to this coil and proceed to adjust the other coil. It is advisable to repeat this routine several times in order to ensure that each coil is really peaked and to eliminate any possibility of the adjustment of one coil effecting the other.

OBSERVED EFFECT

When the two coils are correctly adjusted it should be possible to observe the band-pass effect by tuning the generator past the alignment frequency, the output remaining fairly constant for about 8 Kc each side with a slight hump at the edge of the band, after which the output drops rapidly. Ideally each hump should be the same height, but the alignment may be regarded as satisfactory if they are brought within two or three db of each other.

It is impossible to observe this band-pass effect if the following IF stage is too selective.

The alignment procedure at the high frequency end of the band is quite standard and the three trimmers are simply peaked after the dial has been set to the alignment frequency, usually around 1400 Kc. When the alignment has been completed at this end of the band it may be advisable to repeat the alignment at the low frequency end of the band.

Too much emphasis cannot be placed on the need for accurate alignment, since the entire performance of the tuner depends on all the tuned circuits being correctly adjusted. For this reason it is well worth while spending a little extra time going over the various circuits to check that they are correct.

In the event of no generator being available it is still possible to make a reasonable job of the alignment, providing a little care is taken. However, some kind of output meter, such as a VTVM across the AVC system or a milliampmeter in the cathode circuit of the IF valve, is really essential.

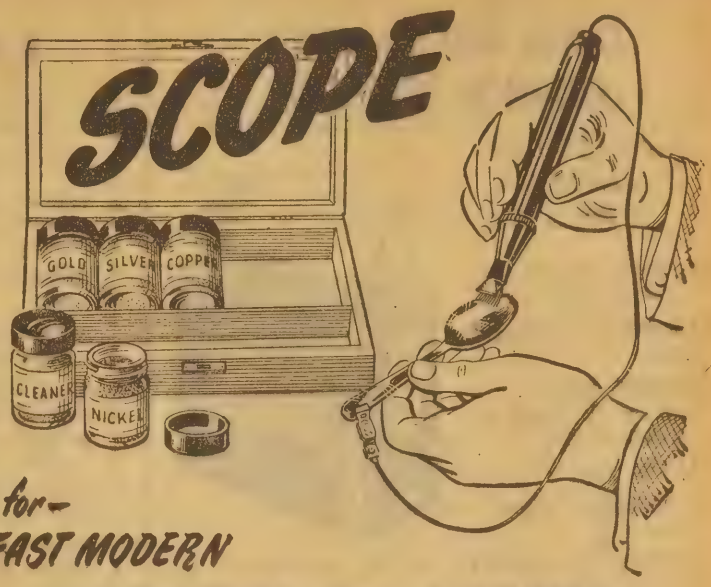
PROCEDURE

First set the pointer on the calibration mark of your local station nearest to 600 Kc and adjust the iron core in the oscillator until it is received at maximum strength. The aerial and band-pass coils may be also roughly peaked at this stage also, after which the tuning is adjusted to a local station at the high frequency end of the band and the trimmers adjusted.

The IF transformers may now be "touched up" (they should be approximately on frequency as received from the makers) and the tuner then reset to the low frequency end of the band. All the above adjustment should be made with the switch in the narrow band position.

Having reset the tuning to the low frequency station, the adjustment of the band-pass circuit may be tackled, using the shunt resistor across each coil in turn, as already described. It is a good idea to reduce the aerial

(Continued on Page 104)



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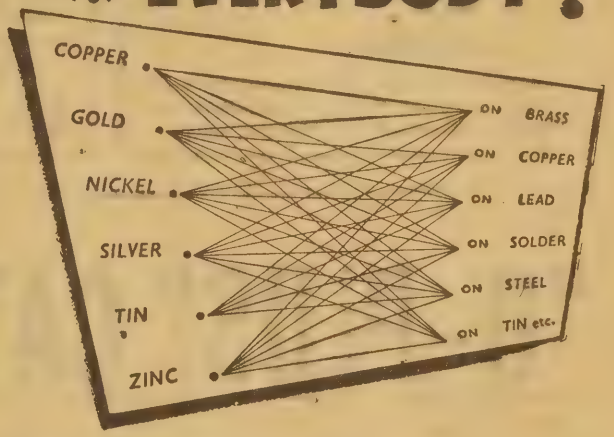

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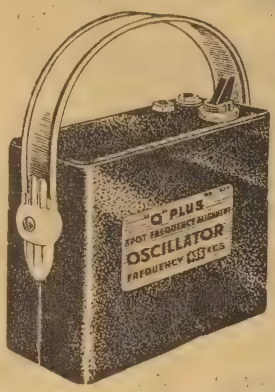


PHYSICAL SIZE: 1 7-8in x 3in x 3¾in.

WEIGHT with batteries 1¼lbs.

BATTERY LIFE: approx. 27 hours, intermittent use.

VALVE: Type 3V4.

BATTERIES: 2 only. Type 703.

FREQUENCY—SIGNAL: 455 kc plus-minus 1 pc (or to special order).

MODULATION: 400cps plus-minus 20pc. (depending on battery condition).

N.B.—Only modulation signal varies with battery life. 455KC signal remains unchanged.

OUTPUT: Banana sockets.

REMARKS

This unit is supplied complete with comprehensive alignment details, showing that all broadcast receivers can be aligned correctly with this unit.

Q-PLUS R.F. CHOKES 2.5 M.H.

TYPES RFC1, RFC2, RFC3.

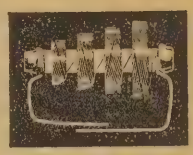
TYPE RFC1.

PHYSICAL SIZE 5-8" x 1"
INDUCTANCE: 2.5 MH plus-minus 10 pc RFCI.

CURRENT CAPACITY: 50 Ma.

MOUNTING: Wound on ceramic former; pigtail leads.

TYPE RFC2 — 3 PI.

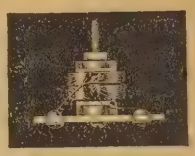


PHYSICAL SIZE ¾" x 1 3-8"
INDUCTANCE: 2.5 MH plus-minus 10 pc RFC2

MOUNTING: Wound on ceramic former; pigtail leads.

SELF-RESONANCE: 2.5 m/cs

TYPE RFC3 — Iron Cored.



PHYSICAL SIZE ¾" x 1"
INDUCTANCE: 2.5 MH plus-minus 10 pc.

CURRENT CAPACITY: 100 Ma.

MOUNTING: 1-8in nut and bolt supplied. Wound on iron post core with 2 lug terminal strip supplied.

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NEW TRANSMISSION LINES FOR VHF

The engineering problem of transferring radio frequency power from one point to another by metallic conductors assumes more formidable proportions as the frequency involved increases. This article by Aerovox Engineers outlines the latest developments in VHF and UHF transmission lines.

IN the portions of the frequency spectrum which are presently being exploited for UFH television, radio relay radar, and amateur communications, the transmission lines commonly employed at low frequencies are no longer practical.

Open wire lines radiate excessively, with attendant high losses. Flexible solid dielectric coaxial lines may also prove excessively lossey, while solid conductor coaxial and waveguide lines are too expensive for many applications.

RESEARCH AIM

For this reason, much research effort is being expended in developing efficient and economical substitutes for such transmission lines. This paper discusses some of the innovations which have resulted from this effort.

The conventional 300 ohm "twinlead" employed as a standard in television practice has never been entirely satisfactory even for VHF low band use in certain conditions. During wet weather excessive attenuation results from the formation of a moisture film on the web between the conductors.

In coastal regions, where there is a high salt content in the fogs during storms, entire areas have undergone television "blackouts" for several days at a time due to the condensation of salt fog on the transmission lines. At such times, television service agencies are swamped with calls from customers demanding that their sets be fixed.

Several expedients have been adopted to alleviate the "fog-out" problem and other shortcomings of standard twinlead. Considerable improvement over the solid ploye-thylene web line has been achieved by resorting to the use of high quality open-wire line in which the conductors are moulded into spaced dielectric spreaders, as in fig. 1a.

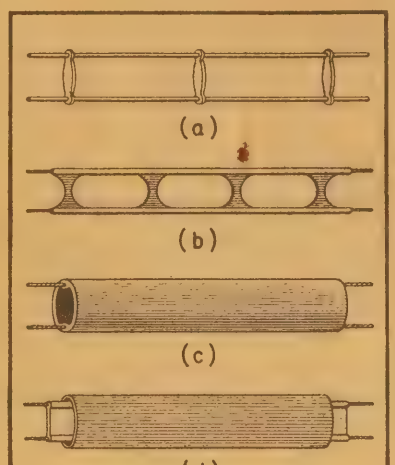
OPEN-WIRE LINES

High impedance line of the type long used in amateur practice (400-600 ohms), has only about one-tenth the loss of twinlead in the low-VHF channels. It is somewhat more difficult to handle, however.

The same end has been attained by removing most of the dielectric web material between the conductors of conventional twinlead, leaving only a narrow spacer at intervals to maintain proper spacing, as in fig. 1b.

The approaches of fig 1a and 1b both minimise the leakage losses by removing as much of the leakage path between the conductors as possible.

Of course, the spacing between the wires must be decreased somewhat to maintain the same characteristic impedance when the continuous dielectric web is removed. This



VARIOUS IMPROVED TWO-WIRE TRANSMISSION LINES

FIG. 1

probably decreases the losses due to radiation somewhat.

Another approach to loss minimisation in two wire line is illustrated in fig. 1c. Here the two wire conductors are moulded into diametrically opposite walls of a hollow polyethylene tube. Losses due to the precipitation of moisture on the line are reduced because the length of the leakage path is increased considerably. Dielectric losses, too, are lessened because the dielectric is now out of the high field region directly between the conductors.

Still another special form of twinlead, similar to fig. 1c in principle, is that shown in fig. 1d. In this variety the condensation of moisture on the web between the conductors is avoided by covering the twinlead with a plastic moisture sheath. The twinlead may be of solid web variety or may have part of the web removed, as in fig. 1b.

Although the special open wire lines illustrated in fig. 1 exhibit vastly improved performance for VHF television applications, they leave much to be desired at frequencies above 300 megacycles.

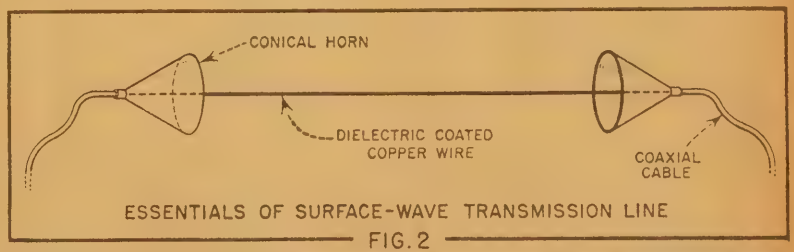
Even solid dielectric coaxial cables, such as the popular RG-8/U, become excessively lossey at UHF television frequencies and almost out of the question for microwave use, except for short lengths. Its losses are about 6db per hundred feet at the low end of the UHF television band and rise to 8db at the high end (890 Mc).

EXCESSIVE LOSSES

At 3000 mc this figure rises to almost 16db, which means that only one-fortieth of the power entering one end of a hundred foot length reaches the other end. Such losses are prohibitive for most usage.

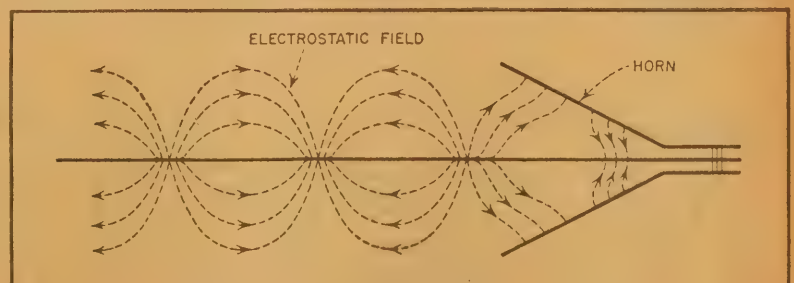
A new type of transmission system which may prove extremely useful in some applications has been pioneered by scientists of the US Army Signal Corps and dubbed the "G-String", or, more aptly, a surface wave transmission line. (Ref. 1). The elements of this system are shown in fig. 2.

The conductor is an ordinary single copper wire covered with a



ESSENTIALS OF SURFACE-WAVE TRANSMISSION LINE

FIG. 2



DISTRIBUTION OF SURFACE-WAVE ON WIRE

FIG. 3

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TYPE AND MOUNTING	IMPEDANCE—OHMS		FREQ. RESPONSE		RATING WATTS	TYPICAL APPLICATION	PRICE
	PRIMARY	SECONDARY	DB+—	CPS			
893-23	5000, 7000	2, 3.7, 8, 12.5	1	*40-15,000	5	SINGLE 6V6G, 6AQ5 ETC, TO VC	28/3
894-23	500	2, 3.7, 8, 12.5	2	50-10,000	5	LINE TO VOICE COIL	26/3
900-22	2500, 5000	2, 3.7, 8, 12.5, 15	1	*40-15,000	15	SINGLE 807, EL34 ETC, TO VC	57/6
896-9	8000, 10,000	2, 3.7, 8, 12.5, 15	1	30-15,000	15	PP 6V6G's A OR AB1 TO VC	62/6
897-9	8000, 10,000	100, 125, 166, 250, 500	1	30-15,000	15	PP 6V6G's A OR AB1 TO LINE	62/6
763-9	3000, 5000	2, 3.7, 8, 12.5, 15	1	40-20,000	15	PP 2A3's A OR AB1 TO VC	62/6
809-26	500	2, 3.7, 8, 12.5, 15	1	50-20,000	15	LINE TO VOICE COIL	42/6
870-26	10,000	2 or 8	1	*20-20,000	6**	PP 6V6G's OR 807's AS TRIODES	57/6
871-9	10,000	2 or 8	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
872-9	10,000	3.7 or 15	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
891-22	6600	83, 100, 125, 166, 250, 500	1	50-12,000	35	PP 807's AB1 TO LINE	82/6
892-22	3200	50, 62, 83, 125, 250, 500	1	50-12,000	55	PP 807's AB2 TO LINE	97/-

DRIVER TRANSFORMERS

545-9	SE 4000 TO PP AB2 GRIDS 1.6:1. PRIM. TO ½ SEC RATIO 50-10,000 CPS 5 WATTS	57/6
588-6	SE OR PP 5000 TO PP 807's CLASS B. 200-5000 CPS 5 WATTS	52/6

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Primary: 3,800, 5,000, 6,600; 8,500, 10,000 ohms. Secondary: 4,000, 5,000, 6,000, 8,000; 10,000 ohms
150 mA. D.C. per side on Primary. 150 mA D.C. Maximum Secondary Current Ceramic insulators.
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TYPE No.	PRIMARY VOLS	H.T.V. ASIDE	H.T. mA	FILAMENTS	PRICE
1682-H	220-230-240	285	60	6.3v-2A; 5v-2A	34/-
1636-3H	200-220-230-240	300	80	2 x 6.3v-2A; 5v-3A	42/9
1332-3H	200-220-230-240	300	120	2 x 6.3v-2A; 5v-3A	53/3
1356-3H	200-220-230-240	400	150	5v-3A; 2.5v-5A; 6.3v-4A	70/-
1380-3H	200-220-230-240	450	200	2 x 6.3v-2A; 5v-3A	95/-
1371-8	200-220-230-240	500-600-750 850-1000	300		150/-
1400-19	200-220-230-240	565-500-425	250	2 x 6.3v-3A; 2 x 2.5v-3A; 5v-3A	110/-
1643-23	200 or 230	—	—	6.3v TAP 5v-2A (500v insul)	17/6
1525-21	220-230-240	—	—	2.5v-10A (1000v insul)	47/6
1305-22	200-220-230-240	—	—	2.5v-10A (3000v insul)	75/-

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TYPE No.	INDUCTANCE-HYS		CURRENT mA	APPROX. D.C. RES.	MAX D.C. Working Vol.	PRICE
	MAX	FULL RATE DC				
957-23	20	15	60	320	500	16/6
973-9	30	20	80	370	500	33/6
[illegible]3-21	30	20	80	370	500	25/9
1012-1A	35	20	120	430	1000	35/3
967-1A	35	20	150	200	1000	46/-
956-1A	30	20	200	160	1000	57/9
[illegible]11-1A	30	15	250	160	1000	59/6
*983-1A	25	20/5	30/300	90	1000	65/6
986-1A	15	10	300	60	1000	62/6

★ **NOTE: 20% SALES TAX TO BE ADDED TO ABOVE PRICE**

★ **MOUNTING DETAILS:**

H—3H: Horizontal mount with steel louvred cover. Sub-terminal panel.
—8: Open steel clamps. Terminal strip prim. & sec.
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thin coating of a dielectric material. The special surface wave is launched on this wire by means of a conical horn, which is fed by coaxial cable. The arrangement is identical at the receiving end, a similar horns transforms the surface wave back into coaxial cable.

A transmission line of this kind is capable of transmitting microwave energy with substantially less loss than the best solid dielectric coaxial cable. For example, at 1000 mc the attenuation of a good surface wave transmisison system is less than 2db per hundred feet, while RG-8/U approaches 9db for the same length.

The low losses of the "G-String" transmission line is attributed to the special configuration of the electromagnetic wave launched on the single wire. Fig. 3 illustrates the assumed distribution of the surface wave on the wire.

DIELECTRIC FILM

The electric field lines start on the wire and end on it, while the magnetic field lines are concentric circles around it. This wave is prevented from radiating freely, as in a long wire antenna by the dielectric film on the wire. This film serves to reduce the phase velocity of the wave and thus, to concentrate the fields of the wave closer to the wire.

The reduction of the radiation is in proportion to the thickness of the dielectric, but beyond a certain optimum thickness, the losses in the dielectric become as serious as the radiation losses. Therefore, for lower losses, the dielectric coating is usually made only thick enough to reduce the phase velocity of the wave on the wire only a few pc below the velocity of light (c), which is the speed at which the wave would travel on a bare wire.

For this small reduction the thickness of the coating is only a few thousandths of an inch. Actually, ordinary No. 12 enamelled copper wire was used in some of the early experiments with this means of transmission.

The manner in which the field is concentrated by control of the phase velocity is shown in fig. 4. This shows the distance from the wire at which the field strength has fallen to 1/1000th of that at the surface of the wire, as a function of the phase velocity for a system in which the wavelength is 100 times the radius of the wire.

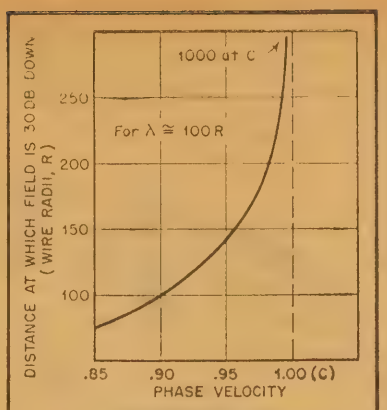
RADIATION

Note that for a velocity reduction of only 1 pc the field extends only about 250 times the wire radius (or about 2.5 wavelengths) from the wire, whereas at the velocity of light the wave extends four times that distance, and would radiate considerably more.

To launch a surface wave mode with good efficiency and intercept most of the energy in it at the far end, the horns should be at least as large in diameter as the extent of the fields indicated in fig. 4.

Thus, for a phase velocity of .90 (90 pc that of light), the horns should be 2 wavelengths in diameter, 2.8 wavelengths for 95 pc of c, and 5 wavelengths for 99 pc of c. The space around the transmission line should be essentially free of reflecting obstacles within this same diameter.

The supports for the line should be



DEPENDENCE OF SURFACE-WAVE CONCENTRATION UPON PHASE VELOCITY

FIG. 4

as nearly reflectionless as possible. In addition, bends and sharp corners must be avoided, since the "G-string" is essentially a straight line transmission device. Corners can be negotiated by transposing back into coaxial line at the bend and then out again, using another pair of horns.

Inasmuch as the diameter of the launching horn assumes impractical dimensions for most VHF television applications, little use for the surface wave transmission line is envisioned for this frequency range. However, in some special community television installations, where a signal from a large antenna on a hill must be transmitted hundreds or thousands of feet into the valley for distribution, this type of transmission line would be economically feasible.

For UHF television use, the same could apply, although at the high end of this band the use of a "G String" for long leadins in standard installations might also be practical. The best application for this mode of transmission lies in the microwave region, however, where it is more economical than rigid coaxial or waveguide, has less weight and wind resistance, and can compete as far as losses are concerned.

"MICROSTRIP" APPROACH

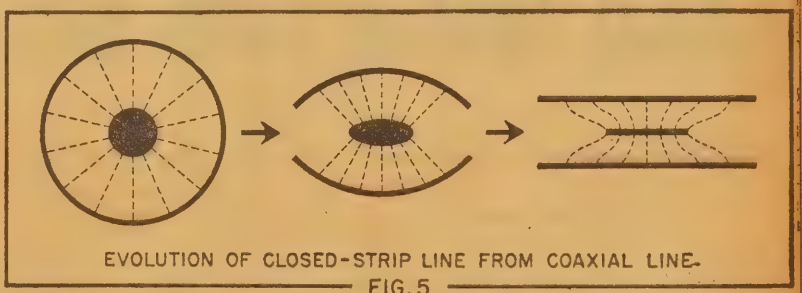
Another new family of transmission lines which are currently being pioneered are variously known as plantar, flat-strip, microstrip, or strip transmission lines. These lines are evolved from ordinary coaxial line in the manner depicted in Fig. 5.

Like the surface wave line, they are useful principally at microwave frequencies, where they show considerable promise for simplified and miniaturized components.

Three types are in common experimental usage; open-strip line, and wire-above-ground line. (Ref. 2, 3.) These forms are shown in Fig. 6.

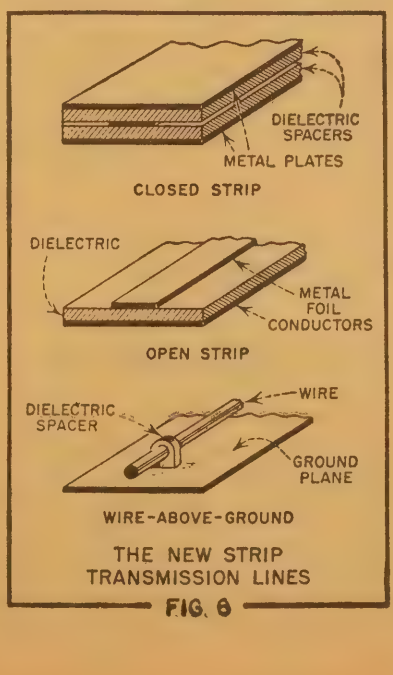
The open-strip line and the wire above-ground type may be thought of as being further evolutions of the closed-strip form brought about by removing the upper strip. They are inferior, to the closed-strip line in some respects, but are more desirable in others. These characteristics can be compared as follows:

(a) The closed-strip line exhibits the lowest losses from radiation since the fields are more completely confined between the outer conductors.



EVOLUTION OF CLOSED-STRIP LINE FROM COAXIAL LINE.

FIG. 5



THE NEW STRIP TRANSMISSION LINES

FIG. 6

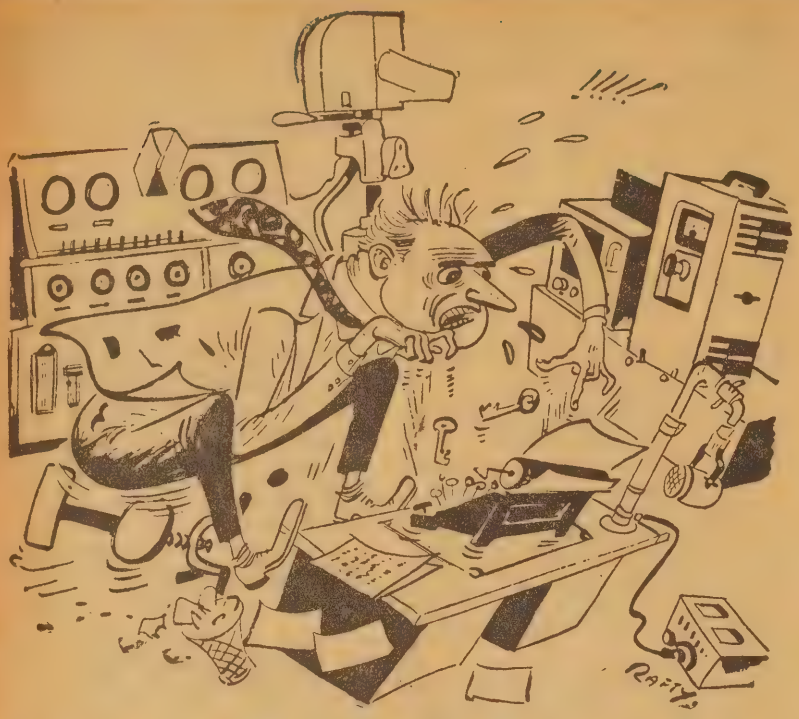
These are usually made at least three times the width of the centre strip for effective field concentration. The Q of this line type is higher than the other two types, making it applicable for use in filter circuits and other components which require this property.

Closed-strip line and circuit elements such as directional couplers, power absorbers, power dividers, transitions, and slotted sections are easily fabricated by laminating the flat centre conductor between sheets of a low loss dielectric and, in turn clamping this "sandwich" between the flat metal plates which form the outer conductors. Circuit components and lines of this type have also been built by the use of printed circuit techniques.

Transitions between closed-strip line and coaxial cable are easily designed. Characteristic impendances of up to about 200 ohms are practical.

(b) The open-strip line is less efficient than the closed type since the removal of the top ground plane allows more radiation. It is con

(Continued on Page 95)



Let's Buy An Argument

Looking through the "Argument" folder the other day, I came across a slip of paper that had been in there for some time. It carried only the two words "Television Plug" but it served to remind me of a subject that is long overdue for public ventilation.

by W. N. Williams

I CAN'T remember exact times and dates but, many months ago now, an advertisement appeared in the press, which advised prospective purchasers that a certain line of receivers now carried a "Television Socket" at the back of the chassis.

In mimicry or in self-defence—I am not quite sure which—various other concerns have since followed suit.

Presumably the public is to believe that a set which is equipped with a television plug or a television socket will not become obsolete as rapidly as another set which is not so equipped. Presumably their foresight (and that of the vendor) will mean substantial saving when television does arrive.

I wonder?

WHAT'S INSIDE?

Inside the set, I believe, the connections to this plug have included such things as heater and high tension wiring, an input facility to the audio channel and, in some cases, just a plain, ordinary pair of 240-volt mains leads.

In the first case you could presumably operate a television "sound only" adaptor from the receiver power supply. There certainly wouldn't be enough "juice" available to run a complete television set.

In the second case, you could presumably feed the output from the television FM detector into the audio channel and thereby save a couple of valves and a speaker.

In the third case, the idea is apparently to stand the television set on top of the existing console, plug in to the AC outlet on the latter and thereby save a lead to the power point. How magnanimous! What foresight!

I may be a nasty, back-biting, suspicious type but I can't help but feel that the "Television Plug" scheme was conceived and delivered in the sales department—not the laboratory!

I've heard various arguments at various times in its favor but none of the said arguments have succeeded in dispelling this unfortunate impression.

To draw a parallel, as some have done, between "television adaptors" of the future and short-wave adaptors of the past is stretching things a bit too far for a nasty, suspicious (but I hope practical) type.

In those days you could plug a little one or two-valve "thingameebob" into the broadcast set and receive short waves. But the adaptor and its function alike were insignificant in relation to the main set—one or two valves against five or six; a few pounds against twenty or thirty!

WHAT A CONTRAST!

By contrast, a "television adaptor" capable of reproducing a complete picture and a sound signal to go with it would be far larger electrically, more complex and more costly than the original set.

Just consider what is involved.

A complete television set must have: (1) An RF tuning system; (2) a twin or dual-purpose IF channel; (3) a video detector and amplifier system; (4) synch. extraction circuits, sweep generators and amplifiers; (5) a power supply for all the above; (6) an expensive picture tube; (7) a power supply for same; (8) an audio amplifier; and (9) a loudspeaker.

The best your present set can do is to replace items (8) and (9) and slightly simplify the power supply. Items (1) to (7) inclusive, all of them substantial, would have to go into a true "adaptor."

Can you seriously imagine a large-set manufacturer solving the many design and production problems in a television receiver, turning it out for (let's say) £150, and then omitting two valves and a speaker for the privilege of saving a "fiver" and feeding the sound through an existing set of unknown quality? No, sir!

SOUND ADAPTOR?

I may be wrong, but what do you think?

Of course, it may be possible to work a smallish "sound only" adaptor from an existing set and obtain a program akin to the "talk" in "talkies." I can well imagine Radio

& Hobbies describing such a device for experimenters, but there's a whale of a difference between a little gadget that all parties understand and the unspoken promise of a "Television Plug." (Yes, a wail of a difference!)

Then, again, the sound channel in a TV set is generally very much subservient in function and design to the vision channel, and I can imagine quality fans diverting the audio through their pet amplifier and speaker system. But how many "television plug"-equipped receivers can boast anything more than a very commonplace audio channel, anyway?

The idea simply doesn't go down, either.

In short, I think it's a pity that the whole scheme wasn't choked at birth.

I can imagine, of course, that some folk may be thinking much the same about yours truly for saying such things. Don't I want to see sets sold? Do I want the receiver industry to fall to pieces? Trained engineers to become street-sweepers? Lesser technicians to become beachcombers?

I certainly don't—not in the middle of winter, anyway! What's more, I don't think they'll have to.

There's enough genuine and justified interest in new recordings, radiograms, amplifiers and so on to provide ample material for sales ingenuity, without resorting to television plugs and their implications.

The "pay-off" will follow later when the customers come back looking for something to plug into the socket . . . "you know, for television, like you told me. . . ."

INTERFERENCE PROBLEM

While still in difficult mood may I refer to the subject of man-made interference, as discussed elsewhere in the issue.

I wonder how long it will be before somebody wakes up to the fact that Australia needs uniform nation-wide legislation to pin down responsibility for man-made interference.

The present patchwork of trade practice, local regulations and earnest requests to "be a good fellow" are as out of date as the Cobb and Co. coach.

The amount of electrical equipment in Australia is increasing right now at an enormous rate and it must continue to do so for as far ahead as we can see. Every new transmission line, every new street main, every new device connected thereto, is a potential reinforcement for the blanket of man-made noise that covers the country like a morning fog.

Our roads are chock full of mobile generators of the Q-R-N for Nancy type.

If radio were an unimportant side issue it wouldn't matter so much. But it isn't.

Radio has become a universal medium for public entertainment and a vital source of public information. The certain advent of television in a few years will enormously increase its role in everyday life.

It controls plane and shipping movements, has become a vital means of communication for a host of public utilities. It's a weapon of war and a tool of science in all kinds of research.

(Continued on Page 95)

THOSE 'SHADDERS ON THER WALL'

Anybody who opens their mouth wide to make a sweeping prediction, is likely to have it stuffed full of their own words. By way of a change from purely radio topics, I'm going to take the above-mentioned risk in the field of "popular science".

JUST about the hottest subject in the entertainment world at the moment is the future of motion pictures—3D, wide screen or just plain "flatties".

While the publicity boys are working overtime, everyone else, from the moguls down to the humble exhibitors, are dithering around and waiting for the public to make up its mind.

If more dramatic methods of presentation will captivate the audience and beat the looming TV threat, then any amount of expenditure is justified. If it won't, then they may as well save their money.

I've seen all the 3D offerings to date and, technically speaking, have been very interested. However, for what it's worth, I'm going to suggest:

(1) That 3D won't be a trump card in the TV/Film battle.

(2) That 3D won't intrigue and captivate audiences, and,

(3) That 3D won't be widely used except perhaps for a few special pictures.

3D "works"—there's no doubt about that, but I base my prediction not on technical factors at all but on audience reaction.

PRESENT SITUATION

Using the present black-and-white sound film, and assuming good facilities, a producer can already achieve something fairly close to the maximum dramatic impact on the average audience for any given story.

If you want a figure to argue about, I'd say that 70 pc of the worth of a routine picture is inherent in the story content, the acting and direction and the technical presentation within the limits of ordinary black-and-white standards.

Anything that may be added thereto, in the way of color, wide screen, 3D, "Smellies" and such like, can't be revolutionary because it only affects the last 30-odd pc. In other words, all the "frills" won't make a bad picture good.

One theatre manager (who strangely agreed with me) suggested that a 3D picture is no good unless it has a good story and (spreading his hands) "if it's as good as all that, it doesn't need to be in 3D!"

Of course, the champions of the idea suggest that we haven't really seen yet what 3D can do.

"You wait till you've seen a really cracker show with natural color, wide screen, better sound—and 3D!"

I admit that it ought to be good—just like many other special shows have been good to our unenlightened eyes in past years. But the standard which CAN be achieved in a special production isn't the standard which WILL be achieved in succeeding run-of-the-mill pictures.

I fancy that most of these will continue to show many of the limitations that we've seen already.

For example, there's an atrocious amount of jitter between the separate images, apparently the product of all the transitional films and sprockets and printings, as well as from the final projection of the two separate prints.

There's the problem of scratched viewing glasses, reduced light, imperfect filters, screen polarisation scatter, tilted heads and so on, all militating against a sharply-focused presentation.

As a result of this and possibly other more subtle factors, the 3D images take on an ethereal quality that has depth but certainly no substance. You can vary the proportions of each to your liking by sitting in the front stalls or in the lovers' row at the back.

I've heard it said that you can get the same "undefined" quality by the simple expedient of covering up one eye while looking at a "flattie." By thus robbing yourself of the ability to "locate" the screen, you get a kind of 3D effect by default!

Of course, all these things can be the subject of learned argument, but the audience won't stop to listen to arguments. They either come back and pay for their 3D glasses or they go somewhere else where they don't need them. In fact, one current picture ad. carries the tag line "you don't need special glasses".

"FREE" SPECTACLE

The wide-screen idea has no complications from the audience point of view. Like color, it's something they get for nothing. Technically, it's not so easy, however, and the present offerings are little more than blown up images with top and bottom lopped off. The central figures are unduly enlarged, the panoramic effect not always achieved, and focus is compromised.

However, this can be corrected by camera technique or a special lens system, and I'm inclined to believe that the public will react favorably to the added spectacle of a wide-screen picture.

What I'm suggesting simply is that the black-and-white sound picture will remain with us for quite a while yet as the basic routine movie. If the producers decide to give all pictures a universal "face-lift", the first standard procedure will be to photograph everything in good color.

After that will come wide-screen presentation, with 3D in last place—so far back, in fact, that it mightn't even show in the form guide.

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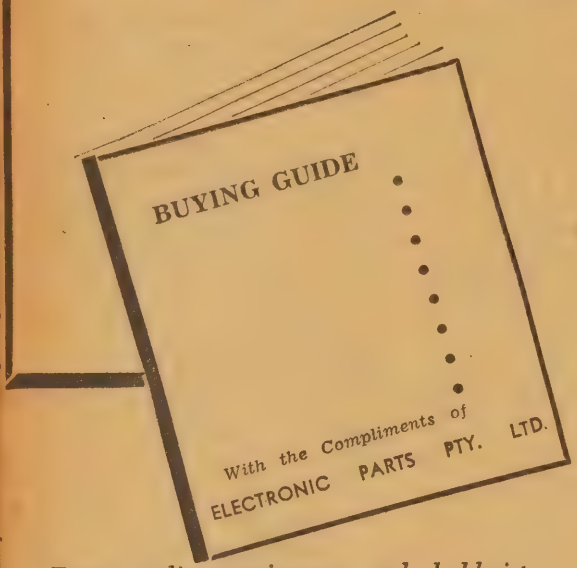

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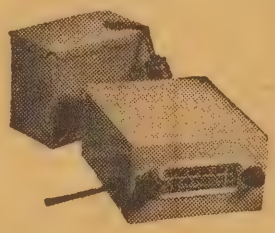
etc., etc.

KAR-SET



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Any one of these services for a group of individuals can be disrupted at any time because someone thoughtlessly instals a noisy gadget down the street.

What's more, people will go on installing noisy gadgets until legislation is brought to bear on the problem.

I know it won't be easy to define what is "noisy" and what is "quiet". What would the terms mean expressed in field strength units? At what frequencies would tests be made? What action could be taken to compel members of the community to instal perhaps costly filters? Would the purchaser be liable or the supplier of the article? Would it lead to excessive cross-litigation?

Yes, legislation would be difficult to frame, but that doesn't make it any the less necessary.

NEED INCREASING

Right now electricity authorities are threading a vast network of high tension cables around the place. One of them passes along the street behind my home.

On certain days you can drive down the said street and hear every insulator on every post spitting and buzzing like some huge electronic locust.

Depending on location, the resultant electrical noise is often heard behind broadcast programs. What it will do to television programs I shudder to think. And how many tens of thousands of homes are now within a hundred yards of such a line? How many will there be within another few years?

How do we stop insulators from sparking over? I don't know, but we'll either have to find an answer or have a goodly section of the community gazing hopelessly at TV screens full of electronic snow.

The average country town provides an excellent example of how a lot of private installations can combine to produce the same blanketing effect. Electric motors, flashing signs, installation faults and such like can build up a field strength rivalling all but the closest stations..

In the city you get the same effect, except that there's more of everything. In fact, if one can interpret local noises properly there's a fair sprinkling of x-ray and diathermy interference around our office, for good measure.

Authorities overseas have woken up to the problem and are bringing into force appropriate legislation.

Here's hoping that local action won't be delayed too much longer.

"HOME TO ROOST"

Lest it be thought that the tone of this column is becoming too pedantic, let me hasten to refer to two letters recently to hand which cannot avoid but have a humbling effect.

The first concerns our whole staff, and is the outcome of an "Answer To Correspondence" in the April issue. We made rather light of the interference problem from fluorescent fittings, and L.J.D. thinks we have a lot to learn.

That's possibly quite true, and for the very reason the correspondent suggests—we haven't been compelled to listen through such interference to distant stations.

I wonder how bad it is in practice? I wonder how effective L.J.D.'s own cure is? I wonder if other readers have ideas on the subject.

As for the letter by J.D.C., there's no virtue in beating about the bush. In one point at least he's right and I'm wrong. We'll get around to that in a moment.

In the meantime, I only hope that his reference to my "scathing comments" in the May issue is an overstatement. To give and take a few gibes is all part of the fun, but "scathing" . . . I hope not.

My reference to a 5.8-volt zero level was wrong, the result of a too-hasty reading of a non-standard scale.

I checked later with a meter expert about zero level readings, and he mentioned several possible systems of calibration, pointing out that scales were commonly laid out to suit prospective customer groups —telephone workers, broadcast engineers, radio servicemen, and such like.

He quoted two other "standards" not mentioned by J.D.C., namely, 1 milliwatt across 5000 ohms, and 50 milliwatts across 5000 ohms.

Which of the five possible references was used as the basis for calibrating the meter in question I don' know. If one of the first three, ther the likelihood of overload during the tests would be remote.

Either of the 50-milliwatt dk markings would have to be made ir respect to a higher voltage scale giving it some other implied voltage equivalent when the meter was switched to, say, the 10-volt range This would bring it nearer the overload region for any possible leaks ir the response curve.

However, as I said before, it's nc use beating about the bush. The chances of amplifier overload would be much more remote than I at first envisaged, and R.P.'s amplifier may indeed be very close to flat.

As for the suggestion that references to decibels in Radio & Hobbies "are usually haywire," that may be a trifle harder to justify, except on a very meticulous basis.

The decibel is based fundamentally on the idea of a power ratio and it has only acquired an abso-

(Continued on Page 103)

Fluorescent lighting

Radio and Hobbies apparent lack of experience with fluorescent lighting noises is partly to be excused since the city areas, being well served with radio broadcasts, are seldom troubled by noisy interference, due to the great field strength from local stations.

However, the fact remains, that fluorescent lighting is particularly noisy to people like "G.J.W." of Port Macquarie. I feel that immediate steps should be taken to make more accurate information available to him and to other readers who no doubt are perturbed by your answer to G.J.W. in the April issue of Radio and Hobbies.

While most fluorescent lighting manufacturers don't publicise the fact, they have nevertheless tried to reduce the noise problem, by devious means, none of which has yet been entirely satisfactory.

A little thought will reveal that the inherent noise is directly radiated from the fluorescent tube to its housing, electrical wiring and conduit nearby whence it is re-radiated and/or conducted to street wiring with the result that wide areas surrounding are affected, too.

Already built into starter type fluorescent units are two capacitors, capable of suppressing the noise voltages. The first is encased by the Starter Switch and the second is directly across the mains.

However, three inherent impedances ensure a constant noise potential across the tube, namely the two cathodes and the ballast.

A glance at a typical fluorescent lighting circuit or wiring diagram will disclose a short circuit across the tube connecting the two cathodes, and across the opposite sides of the cathodes, the ballast choke in series with the power factor capacitor.

Simply by connecting across the ballast choke a capacitor sufficiently small so as not seriously to detune the choke, the power factor capacitor appears as a short circuit to the noise components across the tube.

Capacitor valves up to .02 mfd are effective for 40 watt ballasts and .05 mfd for 20 watt ballasts.

In particularly troublesome instances, where high gain receiving equipment is installed, it may also be necessary to ground the chassis or framework of the fluorescent unit.—Yours faithfully, L.J.D.

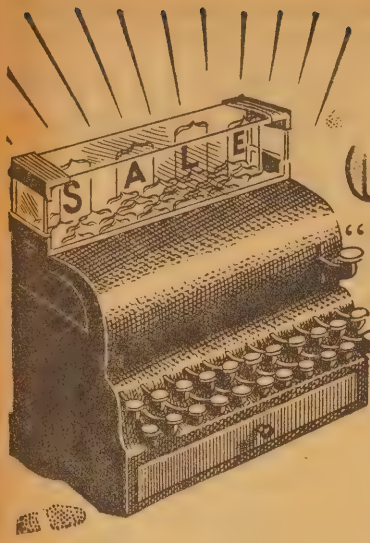
Those decibels

Reference "Let's Buy An Argument" May, 1953, regarding your scathing comments on your correspondent's letter on his attempts to run a response curve on his amplifier. True, I cannot profess to understand RP's remarks about "adjusting the load to give him plus or minus 0 db at 50 c/s and 1000 c/s" and cannot possibly see how he managed to operate with the gain control wide open.

Not withstanding all this you have definitely missed the bus when you start talking about 0 db on a poltmeter scale being 5.8 V. Now in my many years of experience I have not come across any reference level that uses 5.8V as zero level. Take our more common reference levels 6mW into 500 ohms corresponds to 1.73V, 6mW into 600 ohms corresponds to 1.9V, 1mW into 600 ohms corresponds to 0.775V, 50mW into 4000 ohms corresponds to 14.2V.

Taking the most common 6mW into 500 ohms or in other words a meter with for 0 db requires 1.73V across it, across 3 ohms would only correspond to 1 watt, so it is quite possible that no overloading of the amplifier took place.

I have frequently seen references to decibels in Radio and Hobbies and they are usually "haywire". Perhaps you would appreciate an informative and technically correct article on the subject.—Yours faithfully, J.D.C. (Radio Engineer).



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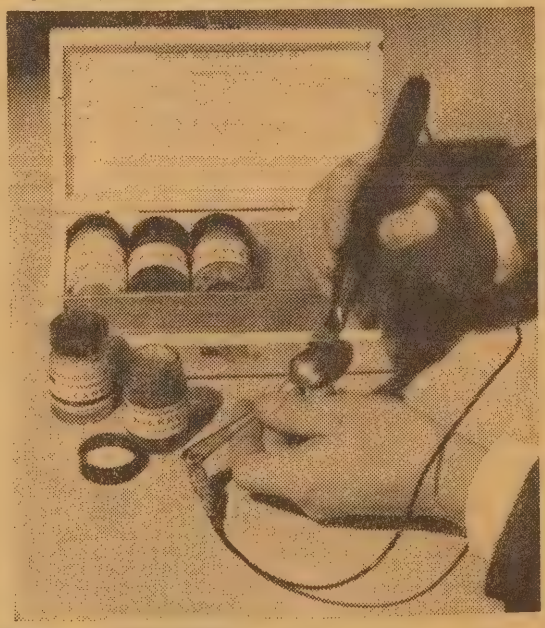

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FROM THE SERVICEMAN WHO TELLS

In spite of something of a last minute rush, my "bag" for the month contains the usual variety which is typical of a serviceman's problems. The two major cases are a PA system and a portable, the latter being an excellent example of how futile it is to guess how much may be wrong with a set before one starts on it.

UNTIL a few hours ago I was wondering where I was going to find enough material, in the form of interesting case histories, to fill my normal quota for the month, most of those which had so far presented themselves being very much of a "routine" variety.

While faults of this kind are most desirable from a purely business point of view, they do tend to become monotonous after a while and one looks forward to something a little out of the ordinary, both to break this monotony and to provide interesting material for the rising generation of servicemen.

I was meditating thus when a customer pushed a portable set across the counter, remarked that it was not working very well, and suggested that it probably wanted a new set of batteries fitted. Could I fit these and have the set ready in a few hours? I said I could, never imaging that I was being presented with an excellent subject for an article.

The best that I could hope was that the customer's diagnosis was wrong and that the real fault might be an interesting one. However, even this faint hope was shattered when I checked the batteries. HT was only 80 volts off load and 74 volts on load, while the filament battery, normally nine volts, was 7.5 off load and a little over six on load. Well, that was that, a new set of batteries was all that was needed to fix this one.

NOT THE FULL STORY

But this assumption was only partly correct. Certainly the set played, and played well, as soon as I fitted the new batteries, but now that it could receive stations it was immediately obvious that the dial calibration was "off the beam". An interesting point about a fault of this kind is that it is possible to judge fairly accurately what has caused the error, simply by noting the nature of it.

For example: If the error is mainly at the high frequency end of the band it is fairly certain that the trimmers have drifted and need adjustment, while an error at both ends, but without any obvious maladjustment of the pointer, usually means that the oscillator tracking requires adjustment either by means of the iron core in the oscillator coil or the adjustable padder, whichever is provided.

A third condition is one where the error is at both ends of the band and the pointer is obviously swinging much further past one end of the scale than the other. This indicates a purely mechanical fault, either the dial drum having slipped on the gang shaft or the pointer having been forced along the driving cord. A further clue to this condition is that the error will be the same physical distance from each calibration mark right across the dial.

Such appeared to be the case now and I decided that all that was necessary was to remove the chassis from the cabinet, shift the drum on the shaft, make sure it was really tight, and put things back together again. (That's what I thought!)

The first hint that all might not be plain sailing came from the battery plug and socket. This consisted of an octal socket mounted on the chassis and a plug wired to the batteries, and appeared to have been fitted to allow an AC operated power pack to be substituted for the batteries if desired. (Hence the series filament circuit operating from nine volts.)

The plug was very hard to remove from the socket and was even harder to replace. In fact, it was almost impossible to insert it completely and, to get it even partly in, called for considerable force. The cumulative effect of these brute force tactics was beginning to leave its mark on the socket, which was only a wafer type, and which had already fractured near one mounting bolt and was clearly about to break away completely.

PLUG OR SOCKET?

This obviously would have to be changed anyway, but the important thing to discover was whether the plug or socket was the cause of the misfit. Several new plugs tried in the socket fitted perfectly so it was clearly the plug which was at fault, though I must confess that I could not detect just why it was faulty. It was nothing obvious like blobs of solder on the pins, and I can only assume that it was one of those rare cases where the pins and central spigot are not quite correctly aligned.

More important was the fact that a new plug would cure the trouble and that a new socket must also be fitted. So I set to work — and for the next couple of hours I was never out of strife!

First a resistor attached to the socket cracked up. It was a carbon type with push-on metal ends (these were never a very robust design) and the movement necessary to disconnect it from the socket and clear a path to remove the latter was more than it could stand. One of the ends detached itself from the body and a new resistor had to be fitted.

MORE TROUBLE

When this was done, the new socket fitted and a new plug connected to the battery leads, I anticipated that I could start on the job for which the set was originally removed from the cabinet, namely, to adjust the dial. But not on your life, the gremlins were only just starting.

The set now proved to be completely dead and preliminary investigation showed that this was due to a lack of filament voltage at any of the valves.

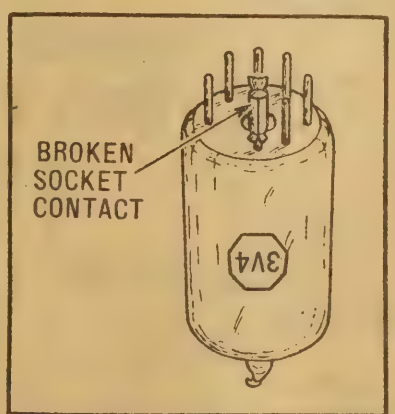
Naturally, with a series network, it only needed the failure of one filament to put all the remainder out of action. Or had I in spite of careful checking, made a blue in wiring the battery plug and socket? This last fear brought me out in cold sweat because it would be all too easy to apply 90 volts to the filament string and be in the red to the tune of five miniature valves.

However, a more careful check with the voltmeter revealed that these fears were groundless and that the filament and HT voltages were, in fact being applied to the correct parts of the circuit. But there was still an open circuit somewhere and, since the correct voltage was applied to the filament line, it appeared that it could only be one of the filaments.

SOCKET TROUBLE

I commenced to remove each valve in turn and check the filament continuity. The first one checked OK but as I removed the second one, the 3V4, the cause of the trouble was clearly apparent. Still adhering to one of the filament pins was part of the socket contact, it having broken off just below the tubular portion.

The cause of this failure was probably a combination of a poorly punched contact with a natural weakness at this point, plus the fact that the 3V4 was in such a posi-



Why the filament circuit failed in the portable. When the 3V4 was removed from the socket one of the socket contacts was still adhering to the filament pin. Failure was probably due to a faulty contact and some movement of the valve in the socket.

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tion on the chassis that it was frequently moved in its socket when the chassis was handled. As a result the contact had been moved back and forth in its socket until it had finally fractured.

In spite of all the bother it had caused there was some consolation in this latest fault. For one thing it was less serious than I had imagined and for another it is not nearly so difficult to repair such a fault as it might at first appear.

Accustomed as most fellows are to completely scrapping a faulty socket and replacing it with a new one, they do not always realise that the miniature sockets lend themselves to the replacing of individual contacts without the need to remove the socket from the chassis.

FITTING NEW CONTACT

A new contact may be obtained from another socket, either discarded for other reasons or purchased specially for the purpose. It can be removed from the socket by simply depressing the small retaining tongue punched into it and pushing it out the top of the socket. The tongue should now be restored to its original shape and the contact inserted from the top of the faulty socket. After being forced through the narrow slit in the base of the socket the tongue will spring out and hold the contact in place.

All that now remains to be done is to transfer the leads to the new contact and the socket is as good as new.

Naturally all the above description is simply a story of what I did to this particular socket and when the connections were completed I switched on the set and was relieved to observe some signs of life.

Now I commenced the task of adjusting the dial drum and this was completed without further incident. However, there was still some slight error in calibration at the high frequency end and I decided to give the trimmers a "touch up" to complete the job. As I was adjusting the pointer to the required calibration mark the dial shaft was suddenly deprived of its normal load and the pointer fell at a crazy angle across the dial. Yes, you've guessed it, the dial cord had broken!

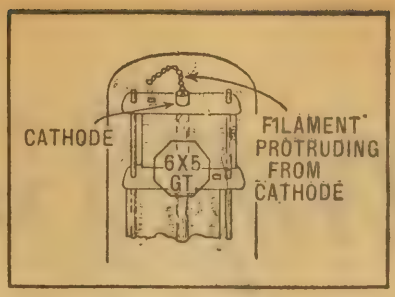
Since I only recently described some of my experiences with dial cords I will spare you the gruesome details and content myself with pointing out (as if it was really necessary) that this dial was no easier to restring than any other. When it was finally completed I felt sure that nothing more could possibly happen, but I was wrong.

ANOTHER FAULT

I completed the alignment adjustments and replaced the set in its cabinet, switching it on to give it a final check while I tidied up the leads and replaced the back of the cabinet.

It was while I was tucking the battery leads into place that the set suddenly stopped, crackled, started again, and then stopped again as I moved the leads. A little judicious moving and tugging of the leads soon revealed the trouble, a classic example of a dry joint where the HT lead from the set was soldered into the small three pin battery plug.

A few minutes work with a soldering iron soon fixed this though I couldn't help wondering how the set had managed to operate for so long



A rather unusual fault in a 6X5 rectifier. Due to some constructional fault the filament was forced out the top of the cathode sleeve, thus seriously reducing the heat applied to the cathode. Indications are that a number of cases have been experienced.

(it was not a new model) with what was virtually a push fit connection to the battery plug.

Probably the most interesting aspect of the above case, apart from its purely technical interest, is the probable repercussions which could result from certain types of customers. Fortunately, I knew this customer sufficiently well to know that he would accept my word that the various things which I had done really needed to be done.

But I hate to think what could happen if the customer happened to be a difficult type. Imagine his reaction when he was confronted with an account for six items over and above the batteries which he had originally specified. He would probably be inclined to argue that all those things could not possibly be wrong with the set because it was working only a few hours before he brought it to the shop and he was sure it was only the batteries.

DIFFICULT SITUATION

He'd be right of course, because several of the faults actually developed while the set was on the bench and, strictly speaking, I was responsible for them. At the same time they could hardly be classified as my fault. Nevertheless the customer could take a lot of convincing.

On the other hand, if I had not discovered each of those potential faults any one of them could have occurred only a few hours after the set had been returned to its owner whereupon the unfortunate serviceman would have the curses of the gods called down upon his head for returning a set in such a condition.

Oh yes, there are plenty of traps for the new chum.

Another set I handled recently gave me food for thought—and comment. The fault in the set was nothing special, simply a gassy rectifier, though I must admit that it put on as brilliant a display of blue light as I have seen for a long time.

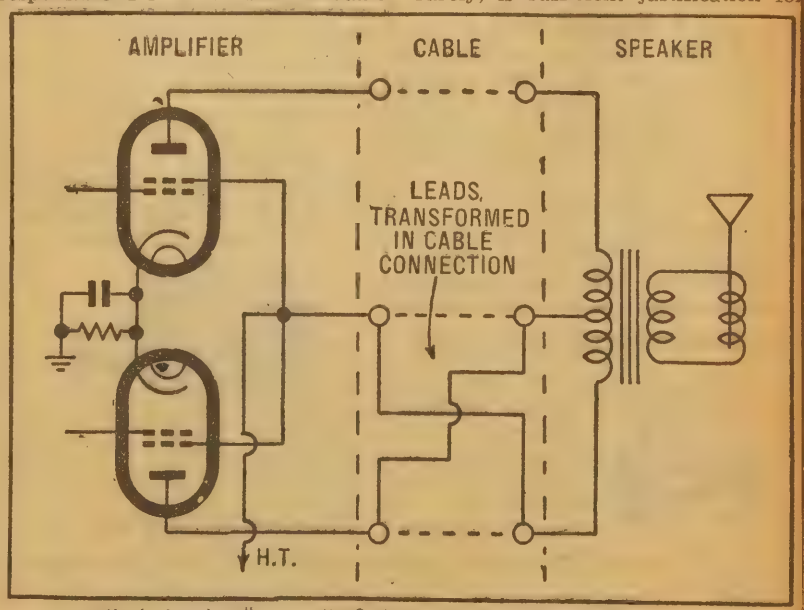
However, there were two points about the set for which the maker could be commended and which were of particular interest from the servicing angle.

VITAL DATA

One was the marking of the intermediate frequency on the IF can in large, easily-read figures which were unlikely to be readily erased. This is such a fundamental requirement that I cannot understand why so many manufacturers still fail to provide it. Surely the cost is not a factor because it is difficult to believe that, even with the cost streamlining of modern manufacturing techniques, it could be an appreciable factor in determining the retail price of the set.

On the other hand it does mean that there is far better chance that the set will be adjusted, when it has to be adjusted, to the frequency originally selected by the design engineer. (Doubtless with very good reason.)

Since this, in turn may mean all the difference between satisfactory operation and unsatisfactory operation, particularly in certain localities it really boils down to the manufacturer supplying something which will ensure customer satisfaction in the greatest number of cases. This surely, is sufficient justification for



A new method of push-pull connection? Not really, just the result of an inexperienced owner trying to extend the speaker cable on a PA system. Without a knowledge of the circumstances in which it failed the trouble caused some head scratching before being found.

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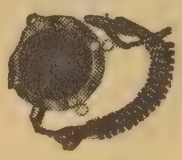

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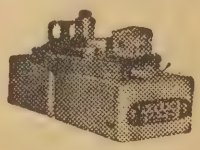

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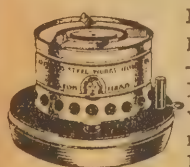

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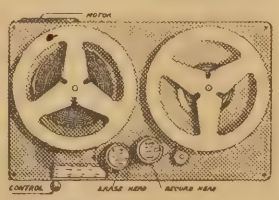

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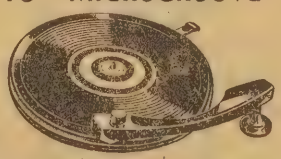

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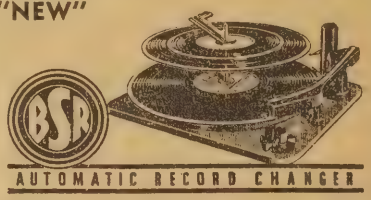

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such a step, even if there are no others.

I hope some of our manufacturers may read this and be impressed thereby.

The other point was the provision on the dial of a "set" line to which the pointer may be set with the gang fully closed before commencing alignment. In this way one is assured that the dial pointer is correctly locked to the gang and that the "law" of the dial calibrations and the "law" of the gang plates will exactly coincide.

It is not generally appreciated just how important is this relationship and that it is virtually impossible to make the dial track correctly if it is not maintained. For this reason many beginners spend hours adjusting trimmers and iron cores in an effort to make the dial track in the centre as well as at both ends; an effort which will be completely wasted if the pointer position is not adjusted.

LABORIOUS PROCEDURE

In the absence of any mark to show the limit of the pointer movement when the dial was originally designed it becomes necessary to adopt a laborious trial and error method, first aligning the set in the usual way and then checking the tracking in the centre of the band. If it is incorrect the pointer must be shifted relative to the gang and the whole alignment procedure repeated. This may have to be done several times in order to produce a satisfactory job.

This criticism applies not only to set manufacturers but also to the dial manufacturers who retail their components for the use of the home constructor. In fact, the home constructor is probably more in need of this information than anyone else because he is frequently a beginner and cannot be expected to know all the little tricks which help the manufacturer and serviceman.

Since the alignment of home constructed sets occasionally falls to my lot, I can speak with feeling on the matter and can assure the dial manufacturers that they would be doing a real service to their customers if they were to provide this facility. The radio manufacturers would likewise be rendering their customers a service by ensuring that subsequent alignment operations on the set would result in calibration accuracy of the same order as when the set left the factory.

Perhaps this appeal may also be read where it will do the most good. Anyway, here's hoping.

PA PROBLEM

Coming back to more everyday technical matters I have a rather interesting case concerning a portable PA system. This was built into two carrying cases, one for the amplifier and the other for the speaker and sundry bits and pieces. The amplifier was a straightforward design employing two 6V6's in push-pull and designed to operate from either the mains or a six volt battery.

When the set was delivered to me I was simply informed that it was very weak and I was unable to obtain any further information as to the circumstances in which it failed. As it turned out the owner could have saved me a lot of time (and himself quite a few shillings) if he had told me the full story. As it was I had to start from scratch and piece things together the hard way.

There was certainly no exaggeration in the statement that it was very weak, for the maximum volume gave the impression of only a few hundred milliwatts rather than the 12 or 13 watts of which it should have been capable.

My first impression was that there was probaly very little HT voltage available and that this, in turn would be due to a faulty rectifier or filter condenser. With this thought in mind I attacked the amplifier and spent some time unscrewing covers

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Here's your answer, Tom!

As you will remember, last month we started to tell Tom about radio valves in response to his request. By way of an important preliminary we went over the electronic theory of matter which led up to a discussion of how electrons may be emitted from solid materials by various means. This in turn, led to a discussion of the simple diode electron tube.

IF there are any points from last month's article that you are not too clear about, Tom, we strongly recommend that you take time off to read it again. The often-repeated parable about the house which was built on the sandy foundation is especially applicable in this case.

Regard the electronic theory and the ideas of electron emission as your rocky foundation, Tom, and your house of ideas won't get washed away when the current starts to get swift.

So much for the preliminaries.

The diode valve has two essential components sealed into an envelope from which the air has been removed. One is a device for emitting electrons and the other a plate to which the electrons are attracted by a positive electric charge. Thus, when a positive charge is applied to the plate, a current of electrons flows through the valve but, when a negative charge is applied to the plate, the electrons are repelled and no current flows.

ELECTRONIC SWITCH

You can regard it as a marvellous switch that works instantaneously and automatically.

When connected so that current flows the electron-emitting device is negative with respect to the plate and, therefore, frequently referred to as the CATHODE. Similarly, the plate is frequently referred to as the ANODE.

Before a diode valve can be made into a useful device for everyday use it must be carefully designed for reliability and efficiency.

For example, just any old piece of wire heated by an electric current will not make an efficient filament. As a matter of fact, wire made from most metals will melt before it begins to emit a worthwhile supply of electrons.

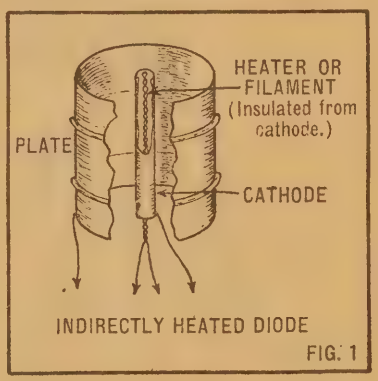
For this reason, one of the most useful materials for filaments is the metal tungsten which melts at an extremely high temperature around about 6000 degrees Fahrenheit. However, at about 4500 Fahrenheit, which is a white heat, tungsten will emit plenty of electrons.

Pure tungsten filaments have the disadvantage against later types that they require a large amount of power to raise them to the required temperature. Their efficiency, in terms of electrons emitted for watts of heating power, is poor.

However, compared with later types, they are both mechanically and electrically rugged and, therefore, find use in high powered valves such as are used in radio transmitters.

If a small amount of thorium oxide is added to the tungsten and the filament subjected to suitable heat treatment, a layer of thorium will be formed on the surface.

The thorium is capable of emitting plenty of electrons at a very much lower temperature than tungsten (actually a bright yellow heat). The emission efficiency of a thoriated tungsten filament is very much



INDIRECTLY HEATED DIODE
FIG. 1

greater than that of its pure tungsten counterpart but it is more liable to damage by electrical abuse.

Most small radio valves these days employ oxide-coated emitters which are able to supply plenty of electrons at relatively low temperatures. Somewhere about 1500 degrees Fahrenheit is a common figure. At this temperature the metal appears only a red color to the eye.

You probably won't want to set up in opposition to the valve companies, Tom, so it isn't important that you have a detailed knowledge of the chemistry of valve filaments. However, it appears that barium and strontium oxides are the principal ingredients.

Plenty of research has gone into valve filaments because it is most important that a minimum of power be used to produce a given emission. Modern valves designed to perform a certain job are able to work with very much less filament power than their equivalents of a few years ago.

Up-to-date we have been speaking about electron emitters in the form of wire filaments which are directly heated by the passage of an electric current. This is an excellent way to obtain emission where there is a steady smooth heating current available.

However, most supply current these days is of the alternating variety and it is desirable that the valves be capable of operating satisfactorily from the supply mains or from the supply mains through a transformer, where a lower voltage is more convenient.

Should the alternating current be applied direct to the emitting filament, the temperature and hence the number of electrons emitted will vary considerably at different times during the cycle.

HUM PROBLEMS

This, in turn, will cause the characteristics of the supply voltage to be superimposed on the electron current flowing from cathode to plate. The degree of resultant "hum" will depend on the reserve of emission and a number of other factors but it is sufficient to state that here are many cases where it is objectionable.

Modern AC valves overcome the problem by using a metal sleeve as the cathode and heating it indirectly by a filament which is inside the sleeve. The sleeve is usually made from a special alloy of nickel, cobalt, iron and titanium. Oxides of barium and strontium are sprayed on the sleeve on the parts where it is desired that electron emission take place just as in the case of directly heated cathodes.

The heat to raise the cathode to the temperature required for emission is obtained from a filament which is placed inside the sleeve. Ceramic-type insulation is placed around the filament to render it electrically independent of the cathode.

By carefully arranging the filament so that any magnetic or electric fields it produces are cancelled out, it can be operated from any convenient supply and the cathode treated as a separate element.

all about diodes...

For the time being, so much for cathodes.

The remaining element in a diode valve is the plate. As with the filament, careful consideration has to be given to its design. Electrons travelling from the cathode strike the plate with a velocity dependant on the plate voltage and the energy due to their speed is dissipated by the plate in the form of heat.

Therefore, a valve which has a high plate voltage applied and which is passing a large amount of current has to have a large plate in order to dissipate the heat.

If too small a plate were used, there would always be the possibility of the plate becoming so hot that it too would emit electrons and, therefore, allow a current to flow in the opposite direction.

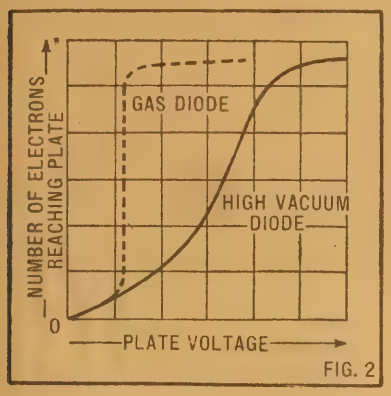


FIG. 2

Valve characteristics can conveniently be given in the form of a graph. Note the distinct difference between a gas diode and the high vacuum type.

The plate is usually a metal cylinder surrounding the cathode. There are plenty of small valves where the power dissipated is small and a simple small plate can be used.

DISSIPATING HEAT

As power ratings increase it is necessary to increase the size of the plate and use specially shaped plates with special coatings which help to dissipate the heat. Some of the heat from the cathode is radiated to the plate and, in designing a valve, Tom, the engineer has to take this into consideration, as well.

Sometimes the plate is made of sheet nickel, although wire gauze has the advantage that heat rays from the cathode can pass through the meshes and there is a larger surface area to dissipate the heat. Frequently the plate is blackened to increase heat radiation and thus reduce temperature rise.

The diode valves we have been discussing up-to-date operate by virtue of a very high vacuum. If air at atmospheric pressure were allowed inside the envelope, the movement of electrons between cathode and plate would be hindered by the atoms of gas of which air is composed.

However, the characteristics of the valve can be changed very considerably and often to advantage by allowing a small quantity of gas or vapor inside the envelope.

A frequent practice is to place a few drops of mercury inside the envelope before it is evacuated and sealed. (Mercury is a metal which is liquid at ordinary temperatures.) When the valve cathode is operating, the heat it radiates causes some of the mercury to vaporise and so permeate the space inside the envelope.

You are, of course, familiar with the parallel case of water which is liquid at ordinary temperatures but which if heated to a sufficiently high temperature becomes a vapor.

The pressure exerted by the mercury vapor depends upon the temperature but it is always very much lower than ordinary atmospheric pressure.

EFFECT OF MERCURY

When the plate voltage is applied to a diode valve which has mercury vapor between the cathode and plate some of the electrons on their way to the plate collide with atoms of mercury.

If the plate voltage is high enough to give them sufficient speed, they will knock some of the electrons from the mercury atoms. The electrons will continue to be attracted by the positive plate and will continue on their way, possibly knocking other electrons from other atoms of mercury as they proceed.

The removal of the electrons from the mercury atoms disturbs their electrical balance, leaving them with a positive charge. The gas is then said to be IONISED and the atoms which are deficient in an electron are called POSITIVE IONS.

Because unlike charges attract each other, the positive ions are attracted to the cathode so that there is an ion current in one direction and an electron current in the other.

Ionisation has the practical effect of greatly reducing the internal resistance of the valve and when the plate voltage is raised to a value sufficiently high to cause it to take place the voltage drop across the valve is practically independent of the current flowing. The limitation is reached when the cathode is no longer able to supply a sufficient number of electrons.

When ionisation takes place, the space between the plate and cathode takes on a bluish-green glow so that it can always be detected by visual observation.

USING A GRAPH

While it is possible to understand how valves work from a general description, a much clearer picture can be obtained if their behavior is illustrated by means of a graph.

If you've had a terror of graphs up to now, Tom, forget all about it. There is nothing to it, as you will see.

For example, you can illustrate the relation between the plate voltage and the plate current of a diode valve by means of a simple graph. (Fig. 2) The reference point is at the bottom left hand side of the graph. A movement to the right can be made to represent the plate voltage while a vertical movement can be made to represent the corresponding plate current.

By way of an illustrative example, say we used the graph to illustrate the behavior of a valve without the heater operating. With zero plate voltage, the plate current will also obviously be zero. If we increase the plate voltage, the current will

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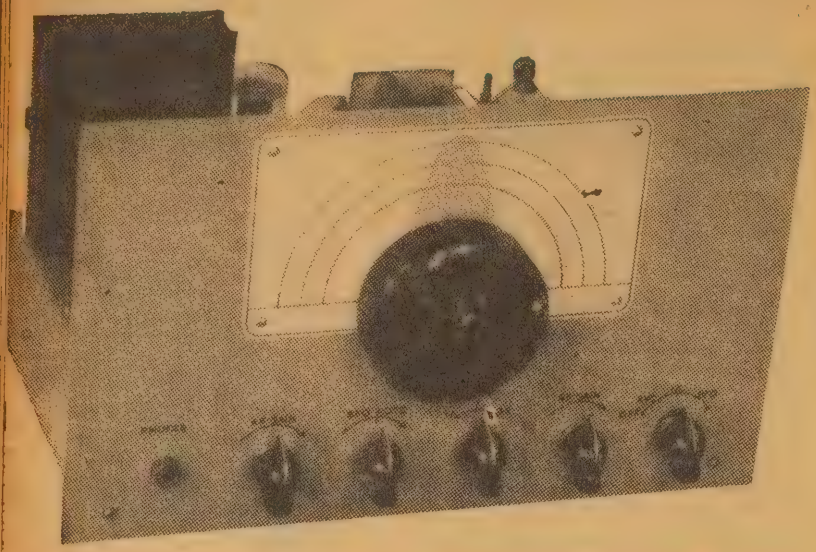


This front view shows the clean panel layout. Various dial types may be used. Both bands are adequately spread.

A 2-BAND AMATEUR RECEIVER

How to build a simple, two-band, switched short-wave receiver for phone and CW reception with easy-to-get parts, many of which can be lifted from the junk box or bought cheaply from disposals counters. The circuit and layout are free from complication but capable of expansion for improved performance. An ideal set for beginners using the 3.5 and 7 Mc bands, it is a companion for last month's two-band transmitter, and could use its power supply if the two are operated together.

THIS receiver is intended primarily as a companion for the two-band transmitter described last month. We had in mind a set which could be made without difficulty by a beginner, whether he is a licensed transmitter or merely a short-wave listener. It was intended as well to be a useful design for the man who might like an extra receiver as a standby, or even as a small job devoted entirely to the 3.5 and 7 Mc bands. For all these people there are certain requirements regarded as essential, and these have been kept in mind in working out the circuit and the layout.

SIMPLICITY

Simplicity is the first requirement. A beginner is apt to be appalled by circuits containing many parts and connections, even though these are not really complicated in themselves. Simplicity also means fewer parts, a saving in money and a saving in time. All these are bound to be important to any builder of the set.

Availability of parts is also important. The set should use components which anyone can obtain easily. If these can be found in the "junk box" —which often contains material anything but junk—or on the disposals counter, so much the better. Many of the parts in our receiver were obtained in this way. Some of the valves, the tuning dial and condenser, sockets, resistors, &c., were all taken from our own disposals hoard, purchased from time to time for just such an occasion. They are all fair samples of the odd components the builder might have or can get cheaply.

Performance is something which really goes hand in hand with complexity. No really simple set can work as well as one more elaborate.

by John Moyle

Fortunately for the 3.5 and 7 Mc bands an optimum degree of sensitivity and selectivity can be obtained much more easily than on the higher frequency bands. Almost anything will give good results and any reasonable set will do well. This set can definitely be classed as a good one. Operating side by side with a much larger receiver, it gave just as readable signals from any stations worth hearing. For all normal work on these bands it is perfectly satisfactory.

The simplest of all short wave receivers are those which use plug-in coils. There can be nothing simpler than wiring all the coil connections to a valve socket and changing bands by changing coils. It is, however, an undeniable nuisance, and our main requirement of two-band operation allows us to use a method of band switching to avoid it. For the amateur who uses these two bands a great deal the receiver is worth while on this ground alone.

POSSIBLE EXPANSION

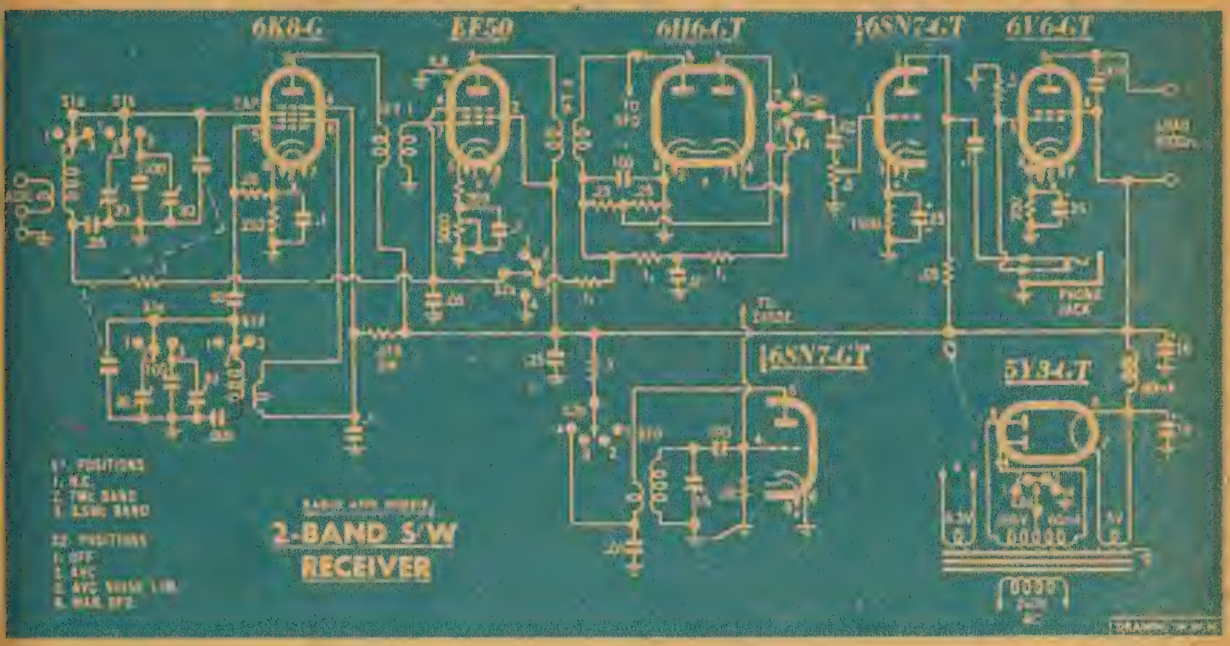
In the layout we have provided facilities not only for experiment but also for expansion. There is a socket position for a separate mixer-oscillator arrangement, for instance, which many prefer. There are socket holes also for an extra intermediate stage for better selectivity. There is room to mount a signal strength meter if you want one, and so on. Modifications of this nature which some day you may wish to make can all be accommodated without wrecking the set or throwing away either the chassis or the panel. We feel such things are quite important, even though for the moment they do not concern us. They will probably be the subject of an article in a future issue, but will not require you to undo any of the basic work in building the set as it is.

A quick look at the circuit will provide the background for considering constructional details as they arise. Firstly, there is no RF stage. The problem of image response and double-spotting isn't acute on either 3.5 or 7 Mc, whereas both are a serious problem on the higher frequency bands. Quite good sensitivity can be realised without an RF stage, which will add very greatly to constructional and lining-up problems. We don't feel we have sacrificed any major requirement by leaving it out, and we have scored heavily on the side of simplicity.

STANDARD CONVERTER

We have used a standard converter valve in the first socket because nearly everybody has a suitable valve available somewhere and the 6K8 is probably the most convenient to use. Practically any other converter such as the 6J8, ECH35, &c., will work without alteration except possibly to the size of the oscillator feedback coil, which may need a turn or two variation for best results.

CIRCUIT DIAGRAM OF 2-BAND SHORT WAVE SET



An extremely simple switching circuit using only one set of coils allows instant band change and easy alignment. The circuit is straightforward and non critical, yet capable of good performance.

Then follows a single IF stage at 465 kc using a high gain valve to give as much lift as possible. Our choice was the EF50 because it is and has been universally obtainable quite cheaply, is reliable, and has the necessary gain. So much in fact that an unbypassed cathode resistor is used to provide degeneration and avoid oscillation.

This resistor is in series with a wire-wound variable resistor which operates as a manual gain control. It may be that when this control is turned to zero, the stage will oscillate weakly. This effect is useful, as regeneration in a single IF stage will greatly sharpen the tuning. Even more elaborate amateur receivers make use of it. In practice, however, plenty of gain will be obtained before this regenerative effect becomes significant, and it is not necessary to rely upon it for useful sensitivity. There is no point in using a fixed cathode resistor small enough to allow oscillation to take place. Its exact value will depend on the type of intermediates used, but it's not a vital matter as the manual control is really an extension of it, and allows adjustment under any circumstances.

I.F. TRANSFORMERS

Almost any IF transformers around about 455 kc can be used in this set. Ordinary receiver transformers are OK although we used a pair of "high selectivity" types we had on hand. These have somewhat lower gain than the standard transformers but even so we can't complain of the over-all sensitivity. It's doubtful whether it would be worthwhile buying them specially, but if expansion to two stages is contemplated, they would probably be a good investment. Standard and high gain transformers are likely to be unstable for more than one IF stage. Most transformers from disposals sets of various kinds will be fine.

One handy feature of the EF50 not possessed by all high gain valves is that the suppressor is suitable for AVC connection. It is, in fact, so good and so cheap that we don't particularly suggest using any other type. It runs with 250 volts on both plate and screen, thus avoiding a separate screen dropping circuit which would be required for instance with the EF39, perhaps the next best choice of disposals types. This valve would require AVC applied to the control grid in the normal way, and has the control grid connection to the top cap.

NOISE LIMITER

The second detector is a 6H6, selected because it is so cheap, and because it allows a noise limiting circuit to be used—a useful feature. We've seen these valves available for as little as 2/-, so that as far as cost goes, we can't really consider

PARTS LIST

1	panel 12in x 7½in
1	chassis 11in x 7in x 2½in
1	vernier tuning dial
1	special 2-gang condenser
1	3-plate variable condenser
4	3-30 pf trimmer condensers.
1	power transformer 285V 60mA HT, 6.3 & 5V filament windings
1	60mA filter choke
1	2-bank 3 x 3 switch
1	2-bank 2 x 5 switch
2	455 Kc intermediate transformers
1	455 Kc BFO coil (see text)
1	6K8-G
1	EF50
1	6H6
1	6SN7-GT or 6SLT
1	6V6-GT
1	5Y3-GT

RESISTORS

3	1.0 meg. ½ watt
1	.5 meg. ½ watt
1	.5 meg potentiometer
2	.25 meg. ½ watt
2	.1 meg. ½ watt
3	.05 meg. ½ watt
1	.015 meg. 2 watt
1	1500 ohm ½ watt
1	5000 ohm ww potentiometer
1	300 ohm 3 watt ww
1	250 ohm 1 watt
1	200 ohm 1 watt

CONDENSERS

2	25 mfd 40 pv electrolytics
2	16 mfd 525 pv electrolytics
1	.25 mfd 400V paper
2	.1 mfd 400V paper
2	.1 mfd 200V paper
2	.05 mfd 200V paper
1	.02 mfd 400V paper
2	.01 mfd 400V paper
2	.005 mfd mica
2	.005 mfd mica
2	100 pf mica
1	50 pf mica

SUNDRIES

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1	9-pin lock-in valve socket
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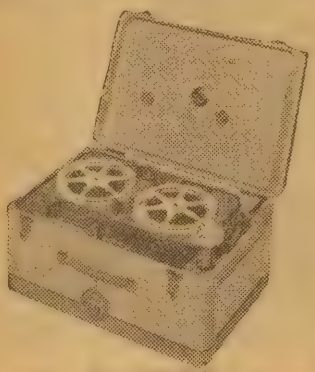

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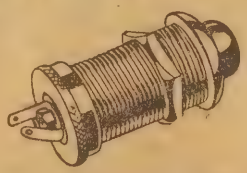

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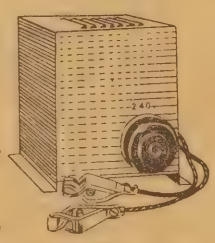

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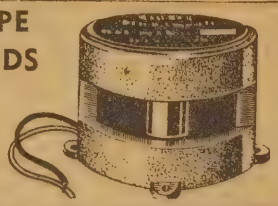

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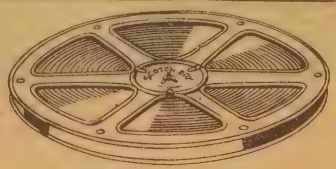

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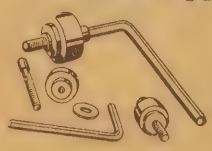

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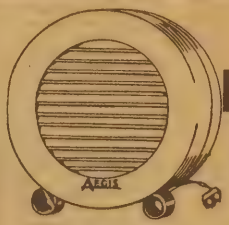

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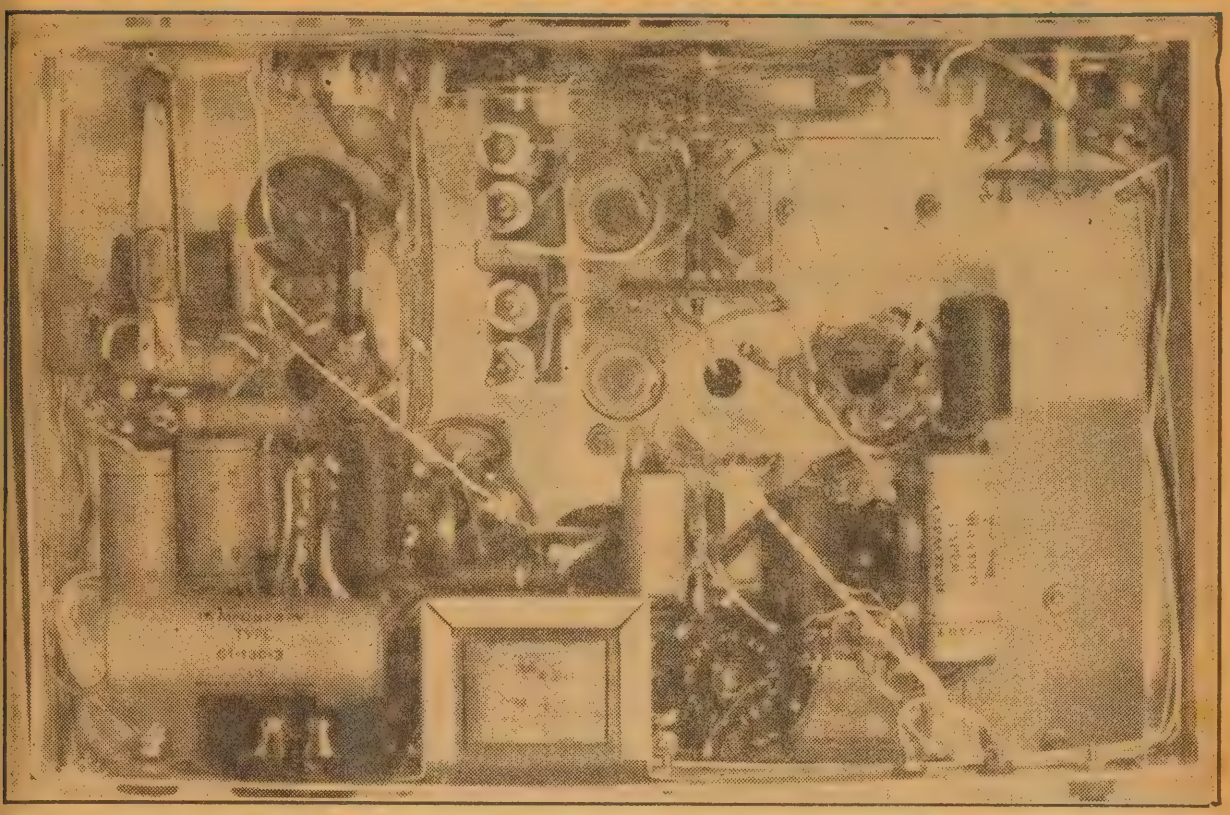

For the sake of clarity, one 8 mfd filter condenser has been removed from alongside its mate. Note the coils, switch and trimmers grouped at the centre of the chassis.

f as anything but a good proposition.

The noise limiting circuit is the standard series type we have used with great success, and it can be switched in or out as desired. It will cause some distortion on heavily modulated signals but otherwise has little effect on the circuit, and automatically adjusts itself to varying signal strengths. It is not used for CW reception.

The AVC is of the simple type obtained from the detector diode. It is switched out for CW reception, and sensitivity controlled by the manual gain control.

The first audio valve is one-half of a twin triode—any twin triode. We used a 6SN7 as probably the most easily obtainable, but a 6SL7 is even better because it has a higher gain. The ECC33 is a 6SN7 equivalent, and the ECC35 has extra gain somewhat below the 6SL7. The only circuit change for any of these valves would be to the bias resistor, and you can extract the exact value from the resistance-coupled charts published in many places. In practice and in this position it isn't a critical factor. The miniature twin-triodes would be just as suitable.

BF OSCILLATOR

The second section of the twin triode is the BFO oscillator, and it is switched on for CW or Morse Code reception. It oscillates close to the intermediate frequency, and is adjusted for beat note by a small trimmer mounted on the front panel.

The BFO coil, therefore, can conveniently be made by adapting an old IF transformer. One of the windings is used for the grid winding, and the other for feedback. When preparing the transformer, take off the shield can and remove the fixed condenser and/or the trimmer from this feedback winding so that it is untuned. The tuning is carried out in the grid circuit only.

FEEDBACK WINDING

Some constructors like to instal a new feedback winding, instead of using one of the original coils, which is removed altogether. The new winding could have 50 turns of 30 or 32-gauge enamelled wire wound close to the grid winding. Results in either case should be the same, the important point is to see that the feedback winding is connected the right way around, otherwise the valve will not oscillate.

The output valve is the last in the chain and feeds the loudspeaker. Any of the standard types can be used, our choice of the 6V6GT being merely because it is perhaps the most common. Even a 6F6 would do. Various others, such as the 6M5, could be used, and give extra gain because of their higher sensitivity.

In all cases the output valve is overbiassed to reduce its plate current. These valves have a maximum output of about 4.5 watts, far more than can be used in normal cases. Overbiassing allows a lower rated power transformer to be used and still provides adequate output. In our case we will still have more than two watts of power with about half the normal drain.

The receiver was built with its own power supply and we adjusted the output valve's bias to an overall current drain of about 60 mA—the transformer's rating. If it is used in conjunction with the transmitter, a switch can easily be arranged to use the transmitter's power supply, which is also of 250 volts. This idea simplifies matters and cuts down the cost. The power supply includes a small 60 mA filter choke and a couple of standard filter condensers of 8 or 16 mfds. A voltage rating of 525 volts is ample. The rectifier is a standard 5Y3GT or 80.

BAND SWITCHING

The problem of band-switching has been tackled in probably the simplest way. It would have been possible to have used a single aerial and oscillator coil tuned by a large condenser to cover both bands without switching. This is fine, except that the bandspread, particularly on 7 Mc, would have been woefully small. Another method would have been to use two sets of coils tuned with a condenser small enough to give better bandspread. This would have involved a fair amount of work and extra coil connections.

Our solution was to use a single set of coils designed for the 7 Mc

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band and tuned with a comparatively low capacitance condenser. Instead of switching to a second coil for 3.5 Mc the switch connects extra capacitance across the coils to tune the circuit to this band. The same tuning condenser is used to obtain the desired band coverage.

This method greatly simplifies construction by eliminating one set of coils, the adjustment of which is probably the major difficulty in coil-switching systems. The extra capacitance is obtained from fixed mica condensers of 100 pf each. Each of the switch positions is provided with a separate trimmer to adjust the tuning for each band—four in all—and a padding condenser of .005 mfds included in the oscillator grid circuit to ensure satisfactory tracking at 3.5 Mc.

The coils are tuned by a two-gang condenser made from a disposals type as found in many ex-Service receivers. As it uses standard sized plates and frame, a modified broadcast type gang could be used instead, for the original was actually a broadcast type made with fewer plates than normal.

All the moving plates except one are removed, the process giving substantially full-scale bandspread from 3.5 to 3.8 Mc. Unfortunately the low frequency section of the dial is much more crowded than the high frequency end, but this is unavoidable unless a condenser having straight-line frequency coverage is available.

PLATE SHAPING

We improved matters by slicing the "hump" from the shape of the condenser plates with a pair of scissors without even taking the condenser from the frame. You could do it with tin snips before mounting the condenser in place, although there is the danger of cutting away too much unless you have first checked the spread with the untouched plates. Our procedure did buckle the plates a little, but we had no trouble in straightening them with pliers to avoid short circuits.

The final result spread 3.7-3.8 Mc over a considerably greater area than 3.5-3.6 Mc, but as the whole band was now tunable over 165 degrees there was plenty of spread at any dial position.

Switching to the 7 Mc band, which is actually 7-7.15 Mc the bandspread was very much smaller for a number of reasons, none of which appear to be avoidable without complicating the issue. However, remembering that the spread is much greater with the plates nearly out of mesh than nearly in, we adjusted the 7 Mc trimmers to arrange the tuning over this portion of the dial. Using the outermost section of the dial scale, the 7-7.15 band was spread over about 1.5 inches, quite a reasonable amount.

Tracking on the 7 Mc band represented no problem, as the coverage is too small for the circuits to get out of line.

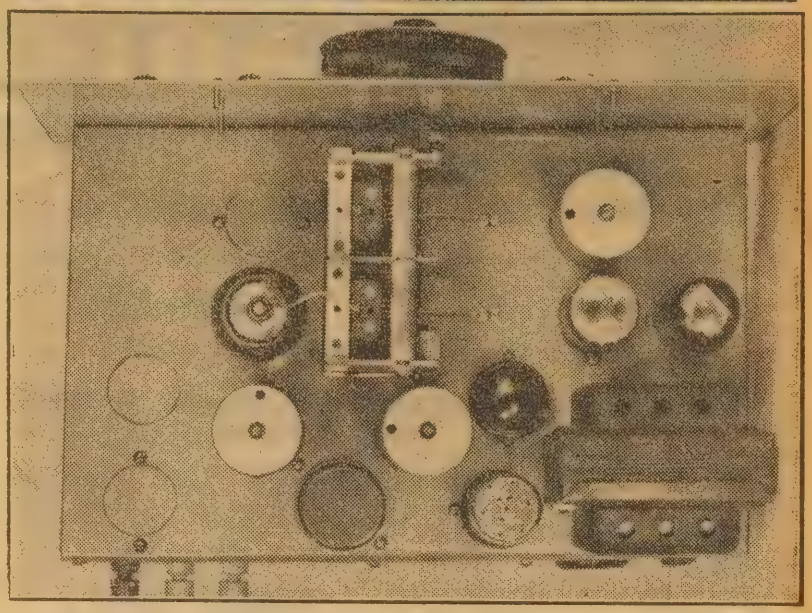
TUNING CONDENSERS

The net result is quick changing from one band to the other, only one set of coils, full bandspread on one band and an adequate amount on the other, and the ability to easily line up each by means of separate trimmers. If the coil data is adhered to the whole job shouldn't take more than a few minutes.

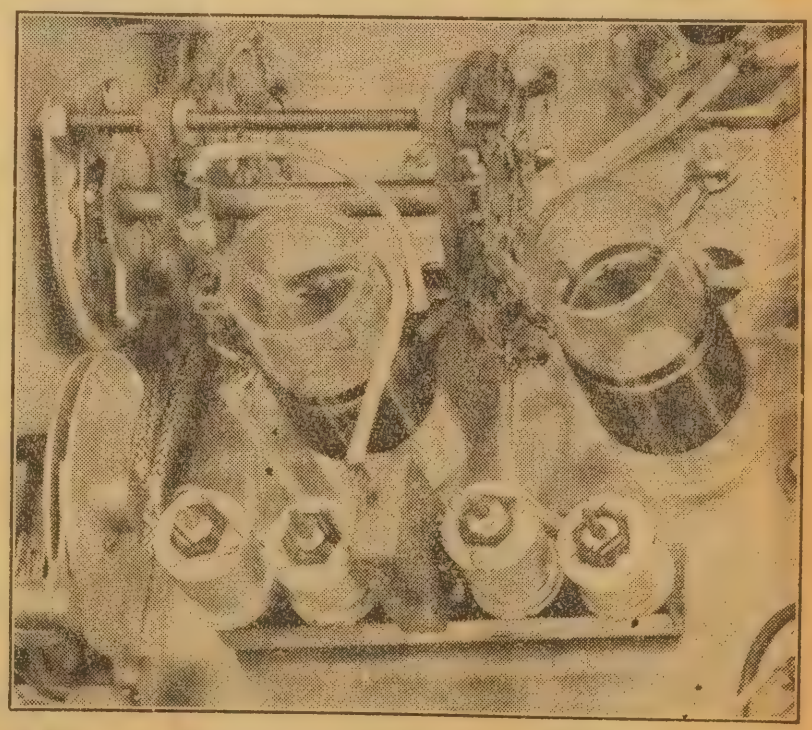
Tuning condensers smaller than the type shown can be used and are available from disposals. Do not reduce the moving plates to less than two for a start with such condensers, although you can easily re-insert plates if you are careful with them when taking them out. At a pinch, new brass plates could be cut and shaped to give more even bandspread, later to be sweated in place. This, however, is really a job for those past the beginner stage. We unreservedly advise using cut-down gangs as against interconnected midget tuning condensers. They are much more rigid, quite easy to handle, and we have seen suitable types on job counters for as low as 2/- each.

Ordinary mica trimmers can be used, but we prefer the concentric type air-spaced trimmers mounted at the side of the switch on a narrow bracket of brass or copper to which the earthed lugs are soldered. Rigid

A TOP VIEW OF THE RECEIVER



This picture shows layout, space for possible additions, and cut-down gang condenser. Coil at top right is BFO coil. Chassis blueprints are available.



Here is a close up view of the coil assembly. The padder is between the sets of trimmers. Trimmers L to R are 3.5 and 7 Mc oscillator, 3.5 and 7 Mc aerial. The 100 pf fixed condensers are hidden behind the trimmers.

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mounting here is advised to avoid the dial calibration changing through vibration, and a drop of clear nail varnish on each will fix them in place when adjusted. We found oscillator stability very good, and only a very small frequency change took place during the warm-up period. There is really no need for either oscillator or aerial coil hand trimmers, although both could be installed if desired, one each side of the tuning dial.

The switch used had wafers of the 3 x 3 type. The third switch position we could use 14 Mc coils, and we may have something to say about them later on.

The leads from the tuning gang come down through the chassis to the switch. The leads associated with the switch might seem rather long and tortuous compared with the more direct wiring to plug-in type sockets —and so they are. However, on these bands, lead length isn't important, within reason, and plenty of communication receivers have leads very much longer than ours.

TUNING COILS

The coils are wound on ¾-inch formers. Some quite nice moulded formers are available, with or without slugs, and these are very nice to use. However, ordinary impregnated coil formers can be used and fitted with wooden plugs to bolt them to the chassis.

The tuning dial is something of a problem. There are only a few types available and they are costly. There is, however, room in the layout to accommodate almost any of them. The movement we used is easily recognisable, and there are various types of dial movement to be had from time to time from the disposals counters, where we found ours. The hand-calibrated scale made of stout cardboard speaks for itself.

Apart from the band switching, all other functions are controlled by another two-bank switch having four switch points to connect to four positions. As the circuit shows, this switch turns the set "off" and "on" by breaking the transformer centre-tap, switches it to a "phone" position with AVC, a similar position with the noise limiter added, and a fourth position without AVC but plus the BFO for CW reception. Quite a few switch types can handle this job.

EARPHONES

For earphone reception a jack is provided to tap the phones into circuit immediately following the first audio amplifier. This also removes audio input from the output valve, thus silencing the loudspeaker at the same time. Only high impedance phones should be used here.

Another idea would be to use low impedance phones and switch them in place of the loudspeaker voice coil, but this would require the speaker transformer to be mounted on the chassis.

No particular originality is claimed for the circuit. It's almost impossible to invent anything particularly new for a simple set of this type. No matter how one chews over the possibilities something like what we have used will result. The rest lies in working on the layout to best meet our requirements.

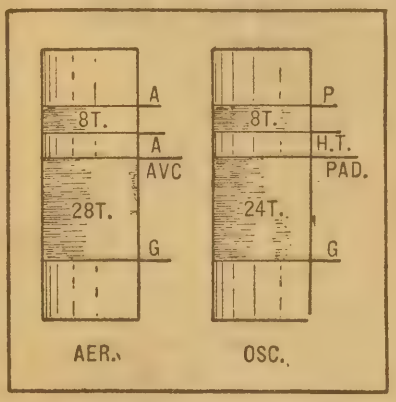
Blueprints are available for the panel and chassis through our regular service, and no doubt the chassis makers will be able to supply them in due course. We used aluminium for convenience, but steel will be even more rigid. A pair of panel brackets would be good, but not an essential. The chassis measures 11 x 7 inches and the panel 12 x 7½ inches.

Provided our general layout is used, there will be no real problem in construction. The wiring of the switch isn't difficult, and if you have any mental confusion about it, sketch it out on a slip of paper before commencing. Both sections are wired up in the same manner.

The connections to the volume control, and the noise limiter leads to the function switch are made with shielded wire to guard against unwanted inter-action. The aerial connection should be kept well in the clear from the IF valve socket, and will allow either doublet connection or the use of a single wire by grounding one side of the aerial coil.

Don't forget our advice to make all the wiring to the coils and the trimmers with rigid leads as short as possible. Any movement in the oscillator circuit or components may alter calibration if the set is moved about. Shielding the converted valve isn't essential, but use a shield if you have one.

Note that the filaments are biased positively by connection to the



This diagram shows the connections to the coils.

cathode of the output valve. This is a precaution against hum due to the noise limiter circuit, which is sometimes experienced with certain 6H6 valves. We don't often come across this trouble, but this connection should avoid or cure it.

Incidentally, any cathode-heater leakage on the noise-limiter section of the valve will affect its operation. Suspect the valve if there is any appreciable drop in volume when the limiter is switched in. The limiter will be found a valuable feature, and a great help in reducing the effect of static which is often so bad on these bands.

Lining up the set will be quite easy if you keep to our coil data. If possible, the IF transformers should be lined up first of all with an oscillator, but if you can tune in signals of good strength you can adjust the IFs while listening without much trouble. The exact frequency isn't important, but correct lining is essential if sensitivity is to be good. With one IF stage there isn't so much over-all gain that we can waste it. Lining up should be done with the IF gain well advanced, and the set switched to the CW position, but with the BFO out of action.

Assuming the IF section is OK, the next step is to line up the hands. With an aerial connected

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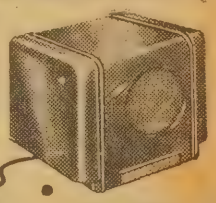

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and the 3.5 Mc oscillator trimmer about half in, you should be able to line the aerial trimmer by peaking it for highest noise level, and if you hear a station, by tuning for loudest signal. If you have an oscillator, use it to provide the signal.

Accurate calibration of the dial really calls for an oscillator unless you are lucky enough to work with someone who has an accurate VFO with his transmitter, and who can give you enough check points. Assuming you can find or obtain a signal exactly on 3.5 Mc, the oscillator trimmer should be adjusted to tune it in with the tuning condenser nearly in mesh. The other end of the band will now be found with the plates nearly all out of mesh. The aerial trimmer can be lined up in the middle of the band, but its setting should not vary, except perhaps by an insignificant fraction, from one end of the band to the other.

Lining up the 7 Mc band follows the same procedure except that the 7 Mc point is set with the tuning plates about two-thirds out of mesh. The 7.15 Mc position will follow with a spread of about 1½ inches. When everything was nicely lined

COIL DATA

AERIAL COIL

Primary: 8 turns 32 B & S enam. wire closewound.

Secondary: 28 turns 24 B & S enam. wire closewound 1/16in from primary. The primary end is connected to the AVC line and the remaining end to the grid of the 6K8-G.

OSCILLATOR COIL

Primary: 8 turns 32 B & S enam. wire closewound. Secondary end to high tension and remaining end to 6K8-G oscillator plate.

Secondary: 24 turns 24 B & S enam. wire closewound 1/16 from primary and in the same direction. Primary end is connected to the padder end the remaining end to the oscillator grid of the 6K8-G.

up, we calibrated ours from a good frequency meter, and this is necessary if the readings are to be really accurate.

The drift from cold to "warmed-up" condition we found to be only a few kc, on either band, and the set has held its calibration without trouble since then.

It is possible by an alteration to the coil switching to include a small series condenser for the 7 Mc band to spread it right over the dial. Apart from the extra complication which might confuse a beginner we doubt the usefulness of the idea. A spread of 1½ inches in practice is quite enough for normal use, and avoids having to wind the slow-motion dial for many turns every time the small band is to be spanned. We will, however, show the amended circuit next month for those interested. Full spread for 3.5 Mc is unavoidable if we are to have enough at 7 Mc as the two are interrelated as it stands, and in any case the band is nearly three times as wide. With full spread on 7 Mc, a vernier dial could almost be dispensed with!

(Continued on Page 103).

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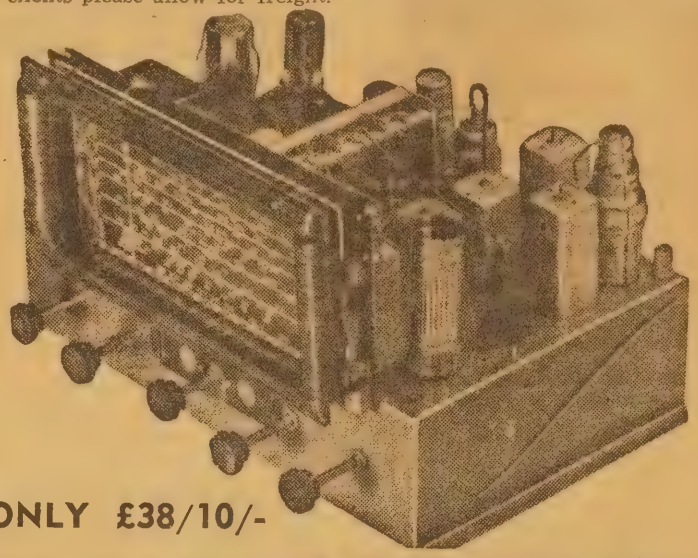

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A SURVEY OF RADAR TECHNIQUES

PART 3—PULSE MODULATOR CIRCUITS

Part 2 of this series dealt with the principles of the magnetron transmitting tube. The present article discusses the means employed to generate the high-voltage DC pulses which are applied to the magnetron.

THIS equipment is variously known as the "pulse modulator", "pulser", or "keyer". The techniques used in this equipment to generate pulses which may be as much as 60 kilovolts in peak amplitude, and yet only one-millionth of a second in duration are typical of radar practices, and so are of interest here.

The basic function of the modulator in a radar set can be illustrated by the elementary circuit of Figue 1.

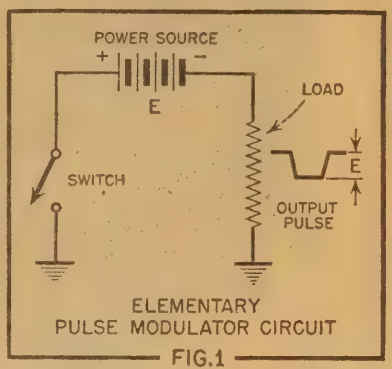
In this circuit, a source of EMF such as a battery is periodically connected to the load circuit for short intervals by a switch or key. The pulse of voltage which appears across the load circuit will be essentially rectanguler if the distributed inductance and capacitance of the circuit is low and this pulse will have a duration equal to the time the switch is closed.

For reasons explained in part 2, most radar modulators are designed to give a negative pulse.

NOT PRACTICAL

In actual practice, the circuit of Figure 1 is not practical because of the high internal impedance of the battery or other power supply and the difficulty of forming very short pulses mechanically.

For these reasons, the circuit is



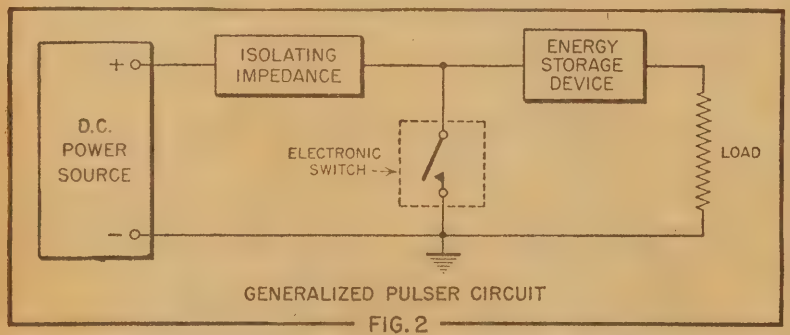
ELEMENTARY
PULSE MODULATOR CIRCUIT

FIG.1

usually modified as in figure 2. Here the energy from a DC power supply is used to charge a storage device such as a capacitor or pulse network.

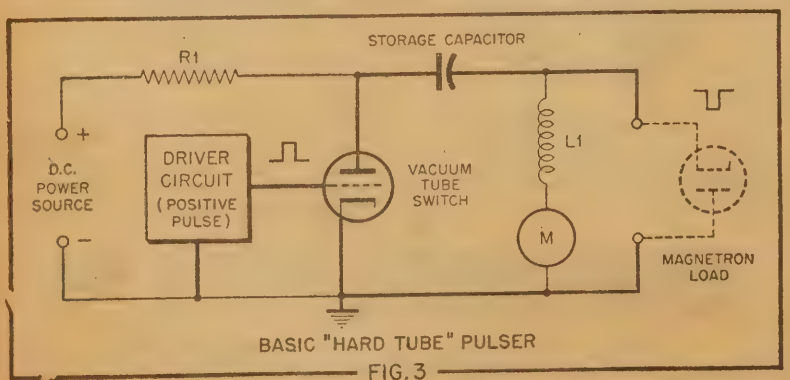
This stored energy is then recurrently connected to the magnetron load circuit for short intervals of time by an electronic switching device.

This switching device may take the form of a high vacuum tube or a gas thyratron. Which form of switch tube is used determines the general category into which any particular modulator design falls.



GENERALIZED PULSER CIRCUIT

FIG. 2



BASIC "HARD TUBE" PULSER

FIG. 3

Since the characteristics of these tw types differ considerably, they wi be considered separately.

Any form of pulser or modulato which utilises high vacuum tubes fo the function of switching the hig pulse currents required by the mag netron is classed as a "hard tube modulator.

The simplified circuit of a pulse of this type is shown in figure 3 In this type, the grid of the vacuu tube, which is normally biased t cut-off, is driven positive by a puls from a "driver" circuit. The stor age device is thus connected t the load circuit for the duratio of the positive driver pulse, and negative pulse appears across th load.

PULSE DURATION

The storage device is usually large capacitor, which is capable o supplying the energy needed by th load during the pulse with only small drop in voltage. This voltag drop is frequently only a few pc.

The storage capacitor recharge from the DC source in the interva between pulses. This interpulse in terval is usually very long com pared to the duration of the pulse

This makes it possible to isolat the DC recharging circuit (shown i light lines in figure 3) from th pulse circuit (heavy lines) durin the pulses by means of isolatin elements such as L1 and R1, whic have very high impedances for shor pulses.

The average current drawn by th magnetron is measured by the mete (M) indirectly, since this meter in dicates the current from the DC source required to replenish th charge on the storage condense This current is equal to the mag netron average current since th condenser discharges only throug the magnetron.

The tube or tubes in the outpu stage of a hard tube modulato must be capable of withstanding a anode voltage equal to the voltag of the required output pulses. The must also be capable of conductin the peak pulse current required b the magnetron.

METALLIC CATHODES

In radar practice, large transmit ting-type triodes or tetrodes ar usually employed. Types havin tungsten or thoriated-tungsten fila ments are the most practical fo this application because the hig voltages involved make the use o oxide coated emitters somewhat mar ginal. The pulser tubes are usuall biased to cut-off or beyond, so tha plate current flows only durin pulses.

The driver circuit used to drive ne modulator tubes to conduction uring pulses may be one of several ypes.

In one system the rectangular ulses are formed at low level by small gas tube or blocking oscil- tor and amplified to the required riving level by several hard tube tages biased to cut-off. Another ethod utilises a medium power ard tube in a special blocking os- illator circuit to form the driven ulses. A third approach makes se of a small thyratron pulser, of ne type to be discussed later, to rive the hard tube final stage.

In any of these driver systems, ne pulse repetition rate is deter- ined by a "trigger" pulse, which is ntroduced into the first driver stage o insure that the transmitter pulse synchronised with the range sweep n the oscilloscope. This synchron- sing pulse is usually generated in ne display section of the radar sys- em.

INE TYPE MODULATORS

Radar pulsers which use gas-filled ubes for the purpose of pulse witching are known as "thyratron" r "line type" modulators. The gas ost frequently employed is hydro- en.

Relatively small tubes are capable f conducting peak pulse currents of undreds of amperes with small oltage drop. In addition, only a mall trigger pulse is required to rive thyratrons to heavy conduc- on. The thyratron differs from ne hard tube, however, in that the rid loses control after conduction as been initiated.

This characteristic results in the asic circuit of the thyratron-type odulator differing considerably om that of the vacuum tube odulator, as is illustrated in fig. 4.

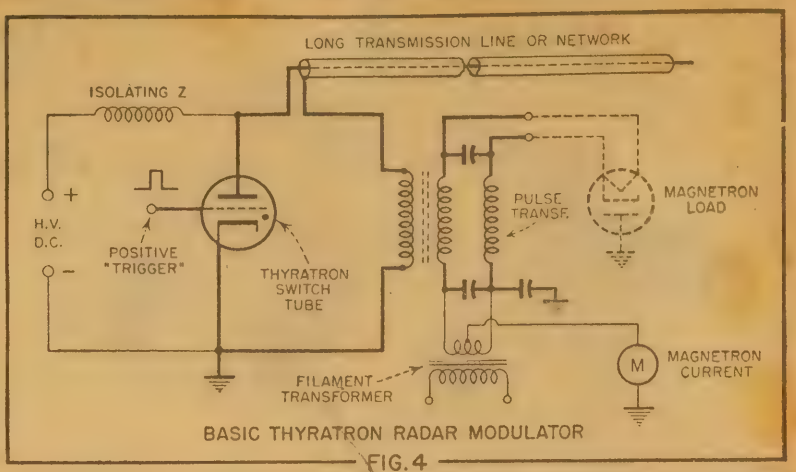
Since the grid of the thyratron incapable of interrupting the plate rrent at the end of the driver lse, the storage device must be a type which discharges entirely uring each pulse. Otherwise, the as in the thyratron would remain nized as long as a voltage existed ross the tube.

A simple capacitor like that used r energy storage in the hard tube odulator cannot be employed, since e discharge pulse would be ex- onential in shape rather than rect- ngular. However, if a length of en-circuited transmission line is arged to a high voltage and sud- nly connected to a load impe- nce equal to its characteristic im- dance, an essentially rectangular rrent pulse flows through the ad.

RTIFICIAL LINE

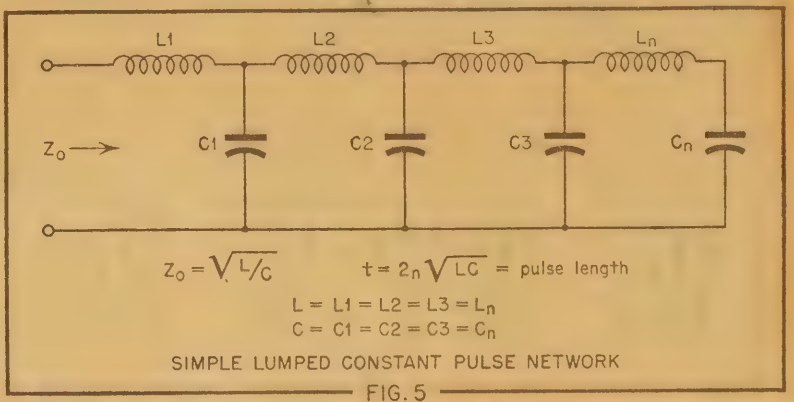
The duration of the pulse so form- is equal to twice the time re- ired for an electrical impulse to avel the length of the line. This ne is determined by the propaga- n constant for the type of trans- ssion line used.

In actual practice, the transmis- n line is usually replaced by an tificial line made up of lumped in- ctances and capacitors for all but ry short pulses. This is because actual line is inconveniently long the pulse lengths most frequent- employed, whereas the simulated lay line, or pulse forming network



BASIC THYRATRON RADAR MODULATOR

FIG. 4



SIMPLE LUMPED CONSTANT PULSE NETWORK

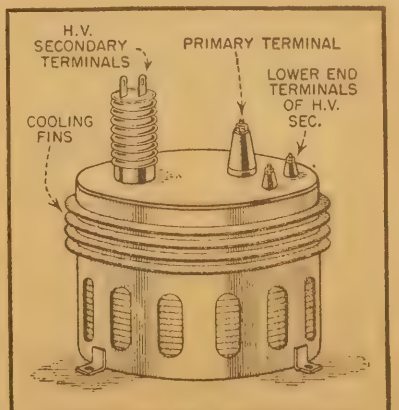
FIG. 5

as it is sometimes called, is quite compact even for 10 micro-second pulses.

Fig. 5 shows one of the possible connections for a pulse network and some of the design constants involved.

The pulse forming network will deliver maximum energy to the magnetron only if its impedance matches that of the magnetron. Since the usual magnetron impedance is between 500 and 1000 ohms, while the design of the pulse line in most practical for low impedances of 25 to 50 ohms, an impedance matching device must be used between the line and the load.

This requirement has led to the development of the pulse transformer, which transforms the impedance of the magnetron load to that of the source. The transformer is specially designed to pass the square pulses. It is carefully designed to minimise leakage inductance while maintaining shunt inductance at a maximum.



TYPICAL PULSE TRANSFORMER

FIG. 6

A special core material having very thin laminations is used to obtain sufficient permeability to pass frequency components up to several megacycles present in pulses having fast rise time.

Pulse transformers which faithfully reproduce pulses ranging from a few hundredths of a micro-second to about 10 micro-seconds are available, althought individual designs are satisfactory over a much smaller range. Turns ratios from about 2:1 up to something like 6:1 are practical.

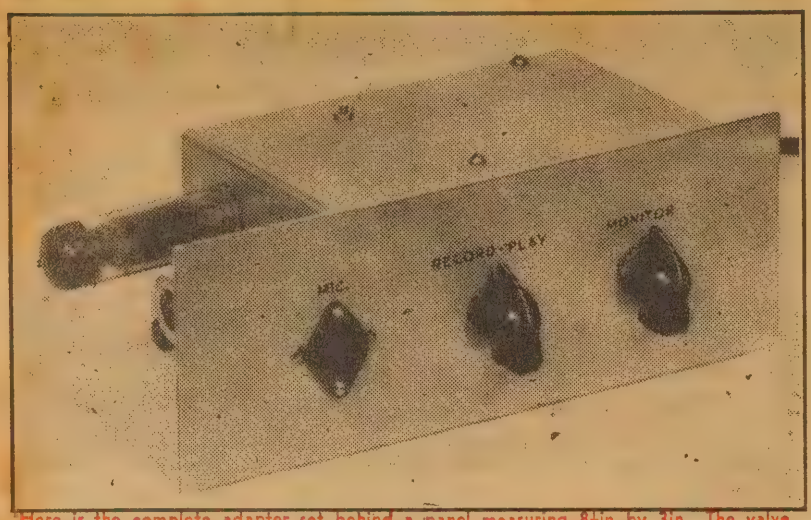
The physical appearance of a typical pulse transformer is shown in fig. 6. As indicated in fig. 4, the secondary of the transformer is usually bifilar wound.

FILAMENT CIRCUIT

This means that the secondary consists of two wires wound as one. This permits the magnetron heater current to be sent through the secondary windings of the pulse transformer from a filament transformer having low voltage insulation. Otherwise, a specially built low capacity filament transformer, insulated for the full pulse voltage, would be required.

Because of the difference in basic circuits, the performances of the two general modulator types differ

(Continued on Page 95)



Here is the complete adapter set behind a panel measuring 8¼in by 3in. The valve in full view at the left is the 6M5 while the shield can of the 6AU6 is just visible in front of it. The control at the right is the "monitor volume control", the "record-play" switch being in the centre. The "microphone input" socket is at the left. This may be of the panel-mounting shielded type.

TAPE ADAPTOR FOR TWO HEADS

Since describing our original tape adapter, some months ago, we have received many requests for details of how to add a power oscillator for electronic erase. In this article we outline the necessary circuit changes and have something to say about using the various oscillator coils which are now available on sale.

by Raymond Howe

YOU will recall the Radio and Hobbies "Tape Adapter No. 1", described in the January, 1953, issue. This unit was intended to provide the necessary link between a tape deck and an existing amplifier or radio. It includes all the necessary frequency compensation, switching and monitoring facilities.

At the time, it was intended that the tape be erased with an AC-operated bulk eraser or with a permanent magnet.

Since then, we have received requests for the provision of high-frequency power erase using an additional head, as incorporated in some of the currently available decks. We have, therefore, modified the original Tape Adapter No. 1 to meet the new requirements.

12AT7 CIRCUIT

As a first step, we investigated the possibility of using the original 12AT7 bias oscillator as the source for the HF erase voltage.

We used the same coil and simply took the output from the secondary winding direct to the erase head, thence to the record/playback head through a 250 pf capacitor. The resulting current through the erase head was just sufficient to erase a half-track recording of average level.

However, in achieving this, the 12AT7 was running well on the way to maximum anode dissipation, a difficult figure to prove. The current drain in these circumstances rises from the previous comparatively low figure to at least 16 mA.

With the output taken from one plate of the 12AT7, the voltage across the erase head was much the same.

In the light of these results, we can only say that if you are prepared, and in a position, to experiment with component values to get the best results, you will probably get by with the 12AT7 as an oscillator to provide both the bias and erase voltages. However, keep an eye on the anode dissipation and the oscillator output waveform.

If the oscillator tends to "squegg", you will get misleading results, as well as introducing the possibility of heterodyning with audio signals impressed on to the tape. "Squegging" readily shows up on a waveform check. Stopping resistors in series with each grid connection minimise the tendency.

Different brands of heads may wo differ in impedance, and some varia tion of the 500 pf coupling capacit value may also be required to reso ate the head inductance at the bia frequency.

Carry out your erase tests with th R/P head connected, otherwise yo will get the wrong impression of th erase capabilities.

ERASE LEVEL

Any change in erase voltage r sulting from circuit experiments ca be noted by clipping a standard mult meter across the head. Set the met to read on, say, the 1000 volt A range. Don't take too much noti of the voltage indicated on the sca as, most likely, it will mean very litt in terms of absolute values.

To give some idea of the possib error in standard multimeter rea ings, when used around the 50 F mark, we tested four different mult meters. With all meters set to th 1000 volt AC range, in a particul set-up, we read off 350V, 550V, 160 290V. For the same set-up, a vacuu tube voltmeter read 165V!

The reading on some of the mete could be varied with hand capaci ance, further complicating the vari shunting effect of the internal wirin

So far, we have been speaking terms of half-track heads. A ful track head may well require a high erase voltage across it (or curre through it), and you may not be ab to obtain sufficient output, anywa from the 12AT7 oscillator.

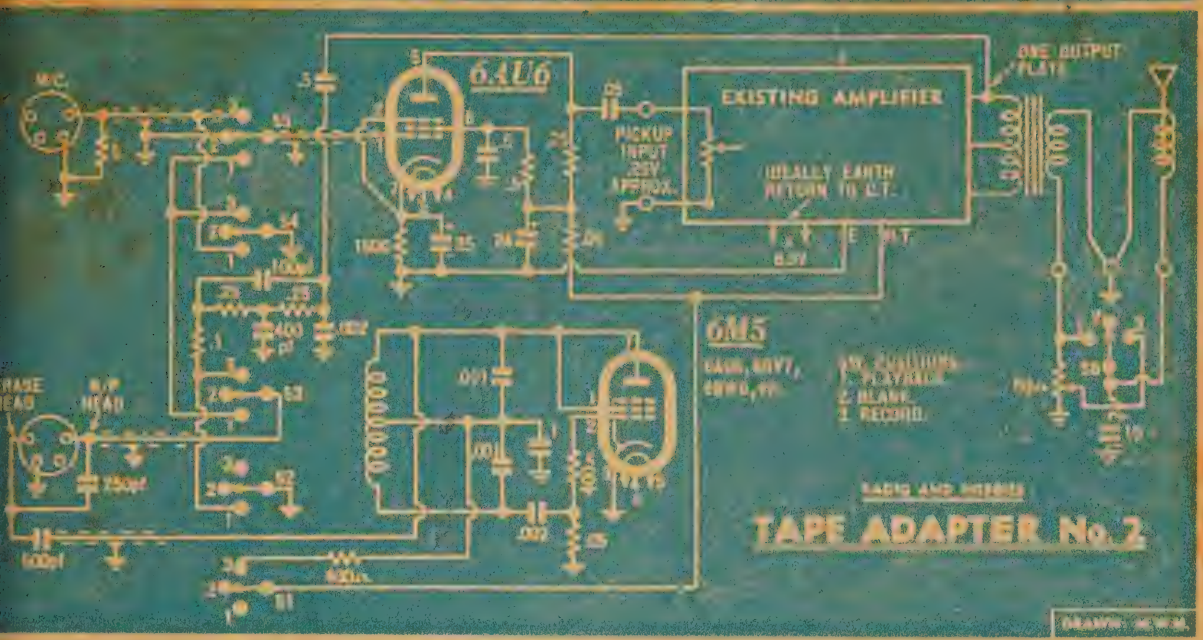
If you have not already built tape adapter, or if you have tri without success to obtain sufficie voltage across the erase head usi the 12AT7, the obvious move is to u a regular power valve as the osci lator. The higher ratings allo more leeway in component values ar operating voltage.

CURRENT DRAIN

The current drain may be litt greater than with the 12AT7, althoug this will depend to some extent upo the circuit and the brand of oscill tor coil. It must be assumed that th source of power to the adapter ca cope with the extra 15 to 20 m drain demanded by HF erasing.

Any power valve of medium G or higher will be OK. We used 6M5, but the 6BW6, 6BV7, 6AQ5, similar valves will do the same jo The valve is triode-connected wi the screen tied to the anode, th cathode earthed and the grid biase by the grid-leak method, as in th usual oscillator circuit.

CIRCUIT DIAGRAM OF R. & H. TAPE ADAPTER No. 2



Here is the circuit diagram of the complete adapter related to the external amplifier and speaker. It differs from the Tape Adapter No. 1 in regard to the method of feeding the heads, the HF oscillator circuitry and the method of oscillator switching. Alternative valve types for the oscillator portion will have different socket connections.

You will note that we arranged the ring of the switch section S1 to ntrol the HT feed to the centre-tap the oscillator coil, instead of earth- g the oscillator cathode, as before. ne 400 ohm resistor and the .1 mfd pacitor at the centre-tap provide measure of RF filtering.

Results vary to a small extent with fferent brands of oscillator coils, t not sufficient to worry you. In these power oscillator tests, we ed a 500 pf as a DC blocking and upling component from the oscil- or plate to the erase head. The P head was fed from the junction the 500 pf and the erase head, as in r "Tape Recorder No. 2".

Incidentally, we have noticed that ne circuits use a value as high as mfd as the coupling and DC ocking component. This is usually nnected permanently across one or th heads, with the result that the P head must be severely shunted ring both recording and playback. is must affect the overall response a marked degree, irrespective of e qualities of the head itself.

APACITOR VALUE

Reduction of this capacitor value l greatly improve matters and we ve found that, with medium to high pedance heads, the value can be ot as low as 500 pf which, by rea- of resonance with the head, ac- lly increases the voltage across head beyond that being supplied m the oscillator.

By feeding the R/P head from the se head through an even smaller ue, 250 pf, the division of bias and se voltages can be controlled and shunting across the R/P head is ligible.

After spending some time experi- nting with the various coils avail- e, we were impressed with the truth of an earlier statement that one must be prepared to experiment with circuits if the very best results are to be obtained in terms of efficiency and waveform.

Our initial tests were carried out with the large coil used in the original tape adapter and Recorder No. 1, and intended for use with the 12AT7 twin triode. This coil is wound on an iron-dust bobbin, has five connections to the main winding and a secondary winding to feed a medium impedance head.

To use it with a single oscillator valve, the primary centre tap and the two outer ends would normally be used, ignoring the two intermediate tappings.

Tuned with the original .002 mfd shunt capacitor, the frequency of oscillation was just under 50 Kc, but the output showed evidence of "squegging". This is seen on the CRO screen as a modulating pattern superimposed on the RF envelope.

AUDIO HETERODYNES

Squegging is totally undesirable, because of the danger of audio-heterodynes, apart from which it tends to affect both plate current and bias output.

At the very least, an effective grid stopper would be necessary, coupled perhaps with more discreet use of the tappings. We found, in later experiments, that better efficiency and waveform generally resulted from replacing the single tuning capacitor with two capacitors in series having their centre-tap earthed.

This would involve replacing the .002 with two series .004 or .005 mfd capacitors, giving essentially the same resultant value, but allowing the provision of an electrical centre-tap.

The miniaturised version of this same brand of coil appeared to require a .001 mfd total shunt or two series-connected .002 mfd capacitors for the same resonant frequency.

It, too, showed a tendency to squegg, which would likewise call for experiment with the coil connections, possibly to the extent of tapping the grid closer to the centre-tap. A stopper resistor would also be indicated.

PARTS LIST

- 1 chassis 5½in x 4in x 2½in with front panel 8¼in x 3in and dividing shield panel 5½in x 2½in.
- 1 6AU6 valve, 1 6M5 valve (or similar).
- 1 9-pin Noval socket and 1 7-pin miniature socket and shield.
- 2 miniature 4-pin speaker sockets and plugs.
- 1 switch 3-pole, 3-position, 2-bank, double spaced.
- 1 bias oscillator coil

CAPACITORS

- 1 25 mfd 40PV electrolytic (miniature), 1 24 mfd 350PV electrolytic.
- 2 .5 mfd 350 VW, 1 .1 mfd 350 VW, 1 .05 mfd (.5 to .05 mfd small size paper), 2 .002 mfd, 2 .001 mfd, 1 500 pf, 1 400 pf, 1 250 pf, 1 100 pf.

RESISTORS

- 1 5 meg. ½W, 1 .5 meg. ½W, 2 .25 meg. 1W, 1 .25 meg. ½W, 1 .1 meg. 1W, 2 .05 meg. ½W, 1 1500 ohm ½W, 2 400 ohm ½W, 1 50 ohm wirewound potentiometer.

SUNDRIES

- 3 terminals, 1yd PTIM coaxial cable, 1yd shielded hook-up wire, 2 pointer knobs, 1 2-tag, 2 3-tag, 2 5-tag and 1 8-tag mounting strips, hook-up wire, insulating sleeving, nuts, bolts, solder, solder lugs.

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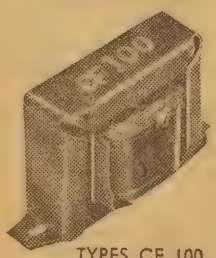
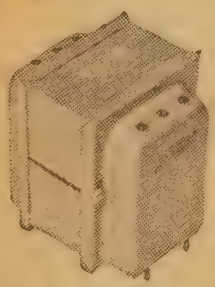


TYPES CF 100
CF 101



ALL
OTHER TYPES

This range includes types suitable for power supplies up to 250 milliamperes rating.

The inductance rating of each choke is the inductance with full D.C. load current plus an A.C. component similar to conditions applying when the choke is in actual operation.

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Type No.	Minimum Inductance Normal DC	Normal D.C.	Normal D.C. Resistance	Normal D.C. Voltage Drop	Total Weight
CF 100	50H	10 M/A	1900 ohm	19V	11b.
CF 101	30H	25 M/A	870 ohm	22V	11b.
CF 102	15H	60 M/A	300 ohm	15V	11b.
CF 103	30H	60 M/A	420 ohm	25V	2lbs. 6ozs.
CF 104	30H	75 M/A	580 ohm	43V	3lbs.
CF 105	15H	80 M/A	250 ohm	20V	2lbs. 6ozs.
CF 106	12H	100 M/A	200 ohm	20V	2lbs. 6ozs.
CF 107	30H	100 M/A	360 ohm	20V	4lbs. 1oz.
CF 108	12H	150 M/A	135 ohm	36V	4lbs. 1oz.
CF 109	20H	150 M/A	225 ohm	34V	5lbs. 4ozs.
CF 110	12H	200 M/A	100 ohm	20V	6lbs. 12ozs.
CF 111	16H	200 M/A	165 ohm	33V	6lbs. 12ozs.
CF 112	10H	250 M/A	70 ohm	18V	6lbs. 12ozs.
* CF 113	20/5H	250 M/A	70 ohm		6lbs. 12ozs.

*SWINGING CHOKE

FERGUSON TRANSFORMERS Pty. Ltd., Ferguson Lane, Chatswood. Phone JA2878

We found, too, that squegging was ore in evidence with the heads fed om the high impedance secondary, ough this does allow for slightly ore efficient operation in terms of as voltage out for milliamps in.

A third coil is commonly available a standard shield can, having a ntre-tapped primary and a low pedance secondary. This latter uld not normally be used for any- ing but low impedance heads.

With the recommended total shunt pacitor of .004 mfd, the bias fre- ency is between 40 and 45 Kc, de- nding on the slug setting and other nor factors. Two series capacitors tween .008 and .01 mfd would give ch the same output frequency.

A grid-stopper proved desirable th this coil, also. The coupling ndenser to the erase head may ed to be somewhat higher than 05 mfd because of the lower oper- ing frequency.

URTH COIL

The fourth coil was a different type ain, being the same as used in the pe Recorder No. 2, in the March, 53, issue. It is of unshielded air- red construction and wax-dipped r protection.

As originally used on the No. 2 corder, the bias frequency was gher than our present target figure 50-odd Kc. This time it is tuned th two series-connected .001 mfd pacitors.

We found, incidentally, that con- cting the grid capacitor respectively side and outside the tuned circuit fected both output and current ain to a small degree and individu- s may care to experiment with both nnections.

Over the period, we took many adings of current and erase volt- es, but under such a variety of nditions that it would be very diffi- lt to tabulate them in any really nstructive fashion. Summing them up, the average loaded oscillator ate current with a variety of valves d coils appears to be 18-20 milli- mps. Figures up to 26-28 milliamps re generally due to inefficient eration, those down around 10-12 lliamps often being insufficient to ford adequate power output.

The erase voltages as read on a TVM hovered around the 160 mark, hough these are dependent on etering error, head impedance and erating frequency. Substantially gher than this seemed unnecessary, ything lower than 100 being pos- bly inadequate.

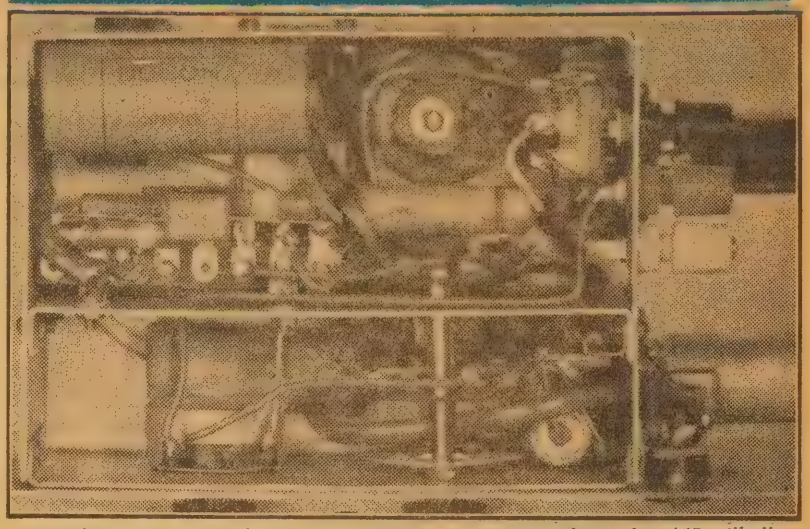
MPORTANT MATTERS

The detailed constructional des- ption given on the Tape Adapter . 1 in the January, 1953, issue. ll apply equally well in this case. ere are several important matters volved, however, and it is worth- hile repeating these.

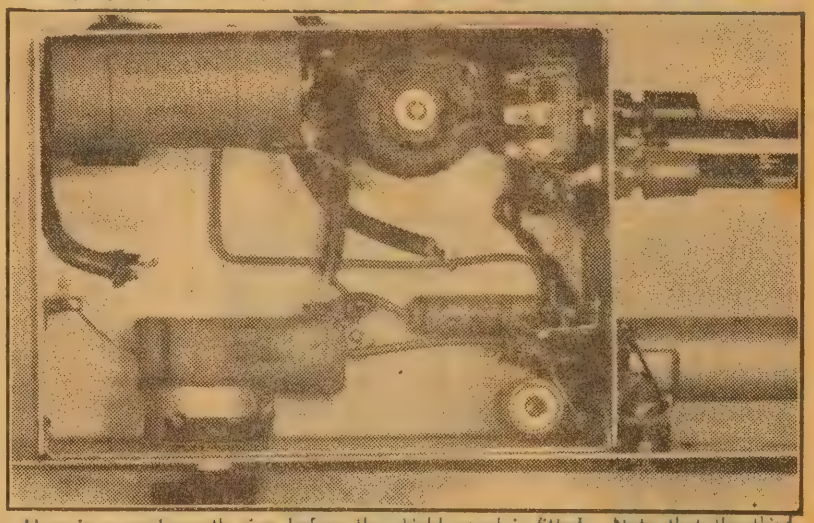
If you intend modifying an exist- g No. 1 adapter and you find that u require a power valve for the as/erase oscillator, it will be neces- ry to remove the shield panel to t at the wiring of the socket.

At this stage, check on the type power valve you intend using. If u have a 6M5 on hand, by all means e it, but you will find that the of the glass envelope will ex- nd about 3-8in beyond the front nel. Whether this would worry

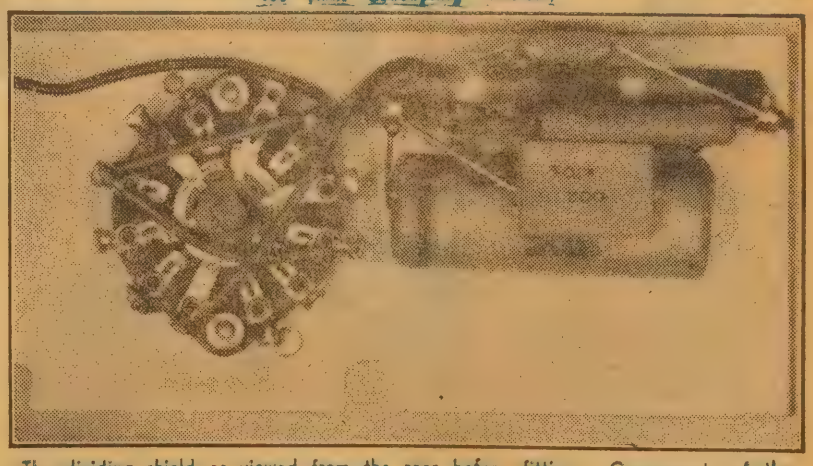
UNDERNEATH ADAPTER CHASSIS



An underneath view of the adapter wiring. At the top right is the 6M5 with the 6AU6 in its shield can below it. The terminals at the right are associated with the speaker voice coil switching. The oscillator coil is at the upper centre, the 24 mfd decoupling capacitor at top left and the compensating T-network at the left centre.



Here is an underneath view before the shield panel is fitted. Note that the third terminal is fitted after the panel is in place. Out of sight under the decoupling capacitor at top left is the power input tag strip carrying the .05 meg. and the 400 ohms decoupling resistors.



The dividing shield as viewed from the rear before fitting. Components of the compensation T-network are grouped at the right on an 8-tag mounting strip.

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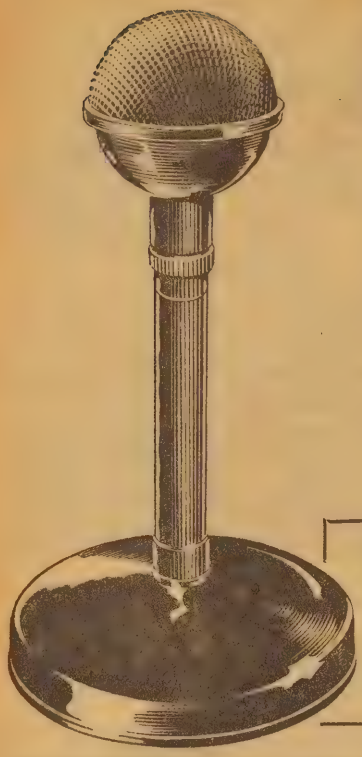

MICROPHONE TYPE MIC 22

Mic 22 is available in 2 types.
Mic 22/2 being complete with desk stand as illustrated.
Mic 22/1 consists of the microphone with nickel plated stem at the end of which is fitted a screwed adaptor which will fit British or American type standard floor stands.
Mic 22/1 can also be used as an effective hand microphone.

MIC 22
PRICE
£9/18/6

SPECIFICATION

Output impedance . . . Equivalent to approximately .002 MFD. (.8 megohm at 100 cycles)
Omni-directional.
Frequency response . . . Substantially flat from 40 to 6,000 cps.
Recommended load resistance . . . Not less than 5 megohms.
Output level . . . Minus 50 db below 1 volt/bar.

MIC 28 LAPEL MICROPHONE

BACK

FRONT

PRICE
£5/19/6

Impedance 100,00 ohms at 1,000 cps.
Capacity .0015 mfd at 24 deg. C.
Output level approximately -55db. Ref. 1 volt/dyne/cm2
Recommended load resistance not less than 5 megohms.
This small non directional microphone has been designed to allow freedom of movement for public speakers or broadcasters. The dimensions of the MIC 28 are 1 9-16in. wide by 2¼in long by ⅝in. thick. It is housed in a soft moulded rubber case which gives added protection against shock. The microphone hooks on to the lapel of a suit or coat. A 20ft. cable is supplied. The MIC 28 has a level frequency response throughout the whole of the audible frequency spectrum, and consequently gives excellent fidelity of reproduction.

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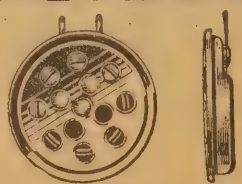
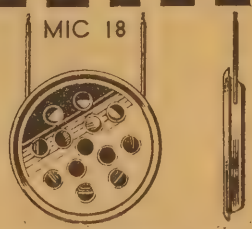


MIC 14

MIC 14. Standard Speech Microphone itself, with nickel plate brass case, which gives high corrosion resistance, mechanical strength and rigidity. Price, 39/3.

MIC 18



MIC 18. Microphone Speech insert provides high acoustic qualities with minimum bulk. Where exceptional slimness is required, this insert is recommended. Price, 39/6.

MIC 32. Sintercel fulfils the quirements for a flat insert good sensitivity and a quency response 30-7000 c/s. affected by vibration, exc tionally robust constructi Price, £2/15/6.

u depends upon where you intend ounting the adapter.
Although we used the 6M5 in our ase-oscillator tests, the alternative pes will work just as well. If you ve a choice, it may be well to nsider the somewhat shorter 6BV7, Q5 or 6BW6.
The pin connections given on the cuit diagram are for the 6M5. you use an alternative type, check e pin connections from valve data ets.
In wiring the socket of the oscil-or, you may need to do a little reful thinking on the placement the minor components before actu-y wiring them into place. Try to ep these components grouped as ich on their own as possible and ward that corner of the chassis. ou may need to use another tag ip.

OUNTING

Switch section S1 on the rear bank ll need to be rewired to control e HT feed to the oscillator. The 0 ohm resistor can be suspended tween the switch and the coil ntre-tap connection. The .1 mfd T bypass can sit either horizon-ly or vertically, depending upon e coil type used.
For those who are building the apter for the first time, the fun-mental points to keep in mind e to avoid undue coupling between e oscillator and the preamplifier id circuit and between the adap-input and output, whether in the cording or playback positions. ther condition could lead to urious responses or just a con-uous howl.
The shield panel is intended to pe with the first requirement while e care in the layout should take re of the second. As the original apter was free of these troubles, strongly suggest that you care-lly follow the layout illustrated in e photographs.
This applies particularly to the ection of the switch sections for e various functions. Use the rangement given on page 96 of e January, 1953, issue, with the ex-ption of S1 section, which should wired according to the circuit agram to control the HT to the cillator. Note that sections are ed to earth some grid and plate ids, when not in circuit, to mini-se feedback.

OUBLE-SPACED SWITCH

The switch should be of the double-aced type, having long spacers be-een the banks. These are nor-lly available on order if your aler has none in stock, but there a chance that they will be readily ailable by now.
You will need to modify the switch ghtly in order to mount it on the eld panel. Remove the rear bank d the spacers and cut the spacers two, so that one portion in each se is 3-16in long. Reassemble the itch with the shield panel be-een the two banks, the rear bank ing closer to the shield panel.
The compact construction of the it will necessitate the section wir-being done in a certain order. is order is covered in great de-l in the January, 1953, issue. We er you to that article, as there insufficient space to repeat the tter here. In general, start at the ttom of the chassis and work out-rd until the shield panel carrying

(Continued on Page 75)

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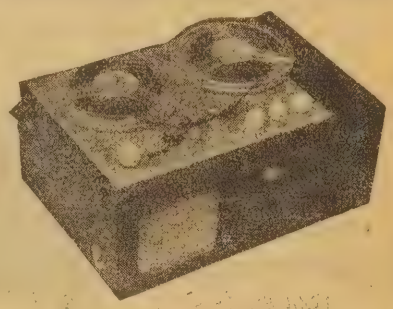

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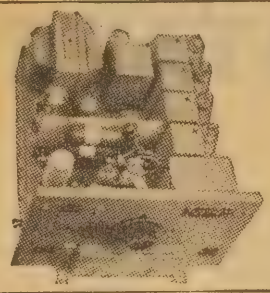

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COMPLETE WITH FOURTEEN 6.3V VALVES AND PLUGS, etc.
IDEAL FOR 144 MEG. BAND

NEW IN CARTON **£4/17/6** GENUINE BARGAIN

PHOTOSTAT OF CIRCUIT AVAILABLE AT 7/6 EXTRA.

American Radar Transmitter Type ASB

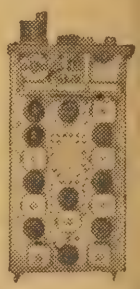
CONTAINS

Two U.H F. Triodes Type 15 E
Four Sets of Lecher Bars.

Transformers, ceramic mountings, Motor Blower, etc. Also High Voltage Vacuum Change-Over Relay. Nominal Frequency 515 m/cs. Ideal for conversion to U.H.F Channels, Variable Coaxial Cable and Link Matching Lines. Contained in Aluminium Case. Dimensions 18in x 7in x 8in.

£3 PLUS FREIGHT

AMERICAN H.F. RECEIVER ASB



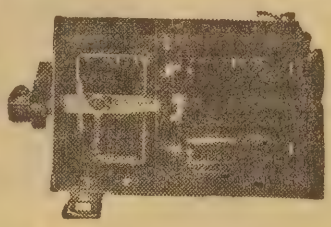
Complete with 11 tubes, 7 6AC7, 2 6H6, 2 955 Acorns. Can be altered to 144 or 280 Mc amateur band or FM band.

£7/17/6 Freight Extra.

NINE VALVE RECEIVER WITH R.F. STAGE FOR THE 144M.C. BAND

9 VALVE RECEIVER USING 6.3V VALVES
SUPPLIED WITH VALVES AND PLUG **£4/7/6**

H.F. Oscillator



Frequency approx. 200 m/c. Adaptable to the 144 m/c Band. Compete with 2-7193 Valves.

Type "B" 12/6
POST FREE

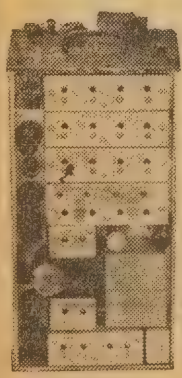
H.F. OSCILLATORS

Complete with 7193 valv ready to use. Tuned by split stator condense worth this amount alone An excellent driver for you 144 m/c. Transmitte Alternatively modulate th unit as it stands.

Type "A" 15/-
POST FREE

— COMMUNICATION — RECEIVERS —

R.C.A. TYPE A.R.B. RECEIVERS



Made in America.

CONTINUOUS COVERAGE 195KC TO 9050KC in 4 SWITCHED BANDS. Valve line up 12 F7 R.F., 12SA7 converter, two 12SF7 I.F. amplifiers, 12SF7 det. and 12A6 output.

£19/10/-
PLUS FREIGHT

Receiver complete with genemotor for 24V operation but readily adaptable for 12V or 32V D.C. operation or 240V A.C. with external power supply.
PHOTOSTAT OF CIRCUIT SUPPLIED WITH EACH RECEIVER

Converted to 240 volt A.C. operation with power supply and 12" speaker.

£29/17/6
FREIGHT EXTRA.

A.R.8 RECEIVERS

MADE BY A.W.A.

Eleven valve receiver using standard 6.3V octal valves. Continuous coverage 140 K.C. to 20 M.C. in 6 bands:

Complete with valves. CIRCUIT AND PLUG SUPPLIED WITH EACH RECEIVER. **£18/17/6** PLUS FREIGHT

Converted to 240 volt A.C. operation with power supply and 12in speaker. **£29/17/6** PLUS FREIGHT

A.T.5 TRANSMITTER

Covering 140 K.C. to 20 M.C. in two separate tuned circuits with provision for crystals and V.F.O. Complete with valves.

CIRCUIT AND PLUG SUPPLIED WITH EACH UNIT. PLUS FREIGHT **£9/17/6**

Aerial coupling unit for above £2/-/-.

METROPOLITAN RADIO SUPPLIES

479 PARRAMATTA RD., LEICHHARDT, N.S.W.

(At top of Taverners Hill). PHONE LM3610

NEW — SPEAKERS — AT — HALF — PRICE

Special purchase of 1000 new Permagnetic speakers made by one of Australia's leading manufacturers enables us to sell these units at half price.

8in SPEAKERS
HEAVY-DUTY PERMAGNETIC WITH 10,000 OHM C.T. TRANSFORMER **34/-**

6in SPEAKERS
HEAVY-DUTY PERMAGNETIC WITH 15,000 OHM TRANSFORMER **29/-**

POSTAGE and PACKING

	NSW	Interstate
12in SPEAKERS	7/6	12/6
8in SPEAKERS	5/6	9/6
6in SPEAKERS	5/-	8/6
TRANSFORMERS	1/6	

12in SPEAKERS
HEAVY-DUTY PERMAGNETIC WITH 5000 OR 10,000 C.T. TRANSFORMER **50/-**
WITH 15,000 OR 20,000 TRANSFORMER 50/-
Separate Transformers to suit any of above speakers — 5000 ohm 8/6 each. (Supplied with speakers only.)

—NEW—RECORD—CHANGER—CLEARANCE—

WORLD-FAMOUS ENGLISH H.M.V. CHANGERS. Fitted with high fidelity lightweight pick-up and matching transformer plays 9in, 10in or 12in records. Finished in Brown brocade. Freight extra. **£8/15/-**

"PAILLARD" CHANGERS. Made in Switzerland these changers are fitted with a variable speed motor, and high fidelity crystal pick-up with sapphire needle. Plays 8in, 10in or 12in records. Freight extra. **£8/15/-**

NEW VALVES IN CARTONS

SPECIALS

AV11 9/9
1K7G 8/6
1M5G 8/6
6K7G 8/6
6X5GT 8/6
VR65A 3/6

Special price for quantity
This valve is the English equivalent of the EF50 with 4v fil, and English octal base. Please add postage on valves.

3S4	15/-
6C4	15/-
6AG5	15/-
EL33	12/6
1S5	15/-
1T4	15/-
1P5	12/6
1Q5GT	12/6
5Z3	15/-
1K5	7/6
6K8	12/6
6SH7	7/6
EA50	7/6
7193	5/-
EF50 with socket	11/6
6SH7 OR 1K5	5/-

In dozen lot.

NEW ELECTROLYTIC CONDENSERS

8 MFD-525v **3/6** each or **34/-** dozen plus post.
8 MFD-350v **2/6** each or **24/-** dozen plus post.
4 MFD-600v **2/6** each or **24/-** dozen plus post.
16 MFD-350v **3/-** each or **30/-** plus postage.

NEW PAPER CONDENSERS

.1-400 volt **3/9** dozen plus postage.
.05-200 volt **3/6** dozen plus postage.
Mixed Mica Condensers .005-600v **3/9** dozen.

NEW VALVE SOCKETS

Teletron 8 pin octal moulded sockets **5/-** per dozen or **25/-** per 100.

American 8 pin loctal high insulation **5/-** per dozen or **25/-** per 100.
Postage extra.

CARBON RESISTORS

Well-known make of carbon resistors in values of 100 ohms to 250,000 ohms. In 1-watt, ½-watt and 1/3 watt. All resistors are standard color coded and in original cartons. In lots of 100 mixed values comprising 50 1-watt, 25 ½-watt, 25 1/3-watt. Post free. **12/6**
IN LOTS OF 500, 50/-.

SOLDER

English resin multi-cored solder in 1lb reels, 10/9 per lb.
POSTAGE EXTRA

Standard Crystal Holders (new)
4 £1/-/- or £2/10/- per doz.
(pins ¾in centres)

NEW B.S.R. MOTORS

English B.S.R. 4 pole synchronous motors 240V or 110V A.C. Ideal for that tape recorder.

£3/17/6 Plus Postage.

TRICKLE-CHARGER KITS

Kits for trickle charger as described in R & H June issue. Comprising transformer with 18V winding tapped at 12V—3 100 Ma rectifiers and 50 ohm control.

39/6 Postage: NSW., 5/-; Interstate, 7/6.

TRANSFORMER SPECIAL

H.D. Power Transformer 265 x 265 150 Ma., 4v Fil. Windings **£2/5/-**
H.D. Power Transformer 365 x 365 150 Ma., 4v Fil. Windings **£2/5/-**
Cro. Transformer 1540v, 2v Filiment Winding **£2/5/-**
250 Ma., Filter Choke **£1/2/6**

METROPOLITAN RADIO SUPPLIES

279 PARRAMATTA RD., LEICHHARDT, N.S.W.
(At top of Taverners Hill). PHONE LM3610

A.C.E. RADIO

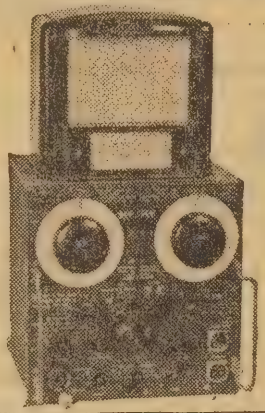
Amplification Communication Electronics

PHONE: LA3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

EVENINGS & WEEKENDS: "KALUA," COLLAROY ST., COLLAROY—XW5956

DULWICH HILL, UNDERCLIFFE, EARLWOOD, TRAM AT DOOR. STOP NO. 42



COMMUNICATIONS RECEIVERS

AR8

6 BAND COVERAGE 140K.C. to 20meg.

12 VALVE

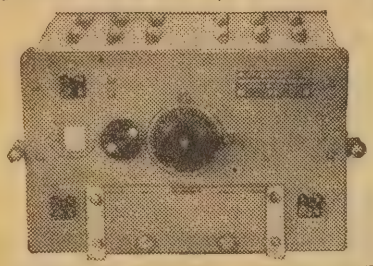
Converted for 240v A.C.
INCLUDING
Speaker and Power Supply
Airtested Perfect Performance

£29/17/6

NOT CONVERTED OR TESTED **£18/17/6**

IDEAL FOR AMATEUR, EXPERIMENTER, DX LISTENER
OVERSEAS RECEPTION.

500 NEW V.H.F. 14-VALVE TRANSMITTER RECEIVERS



150 to 180 MEGS

SUIT AMATEURS. VEHICLE BAND. EXPERIMENTERS

All brand new. In original cartons including plugs and cables

£4/17/6

PHOTOSTAT OF ORIGINAL CIRCUIT NOW AVAILABLE 7/6 EA.

SELSYN TYPE MOTOR

Can be converted to 50 volt A.C. Condenser Start Motors.

Price each **£1/-/-**

Per pair **£1/15/-**

Ideally suited for Tape Recorder with suitable resistor or transformer.

NEW AWA HEAVY DUTY GAS FILLED VIBRATORS

6 VOLT

15/-

CRYSTALS

1000 K.C. £1/7/6
455 K.C. £4/17/6

SPECIALS TO ORDER
DELIVERY 7 DAYS
2 TO 10 Meg. .01%

FT243 or D.C.11 Holders as required

£3/15/-

AMERICAN INDICATOR UNIT—NEW!

for that C.R.O.

£9/17/6

Complete with Valves

3 Element Antennae Array

130 TO 220 MEG

ADJUSTABLE STUBS WITH COLLETS

TWIN COAX FEEDERS **£2/12/6**

Aerial Matching Unit to Suit 15/-

BENDIX

FREQUENCY METERS—BC221T

NEW CONDITION **£45/-/-** TESTED

HEAVY DUTY POWER EQUIPMENT

POTTED TRANSFORMERS

265 x 265v 250 Ma £2/5/-
365 x 365v 150 Ma £2/5/-
1540 CRO Transformer £2/5/-
250 Ma Choke £1/2/6

OIL FILLED CONDENSERS

8 mfd 500v 10/- .5 mfd 2500v 6/6
1 mfd 600v 5/- .25 mfd 3000v 6/6

N.B.: These condensers are conservatively rated and can be used successfully at Higher Rating.

GENEMOTORS

Input	Output		Price
24V.	250V.	60Ma	£1/2/6
12V.	250V.	65Ma	£3/-/-
12V.	275V.	100Ma	£3/10/-
12V.	350V.	50Ma	£1/10/-
24V.	250V.	100Ma	£1/10/-
24V.	300V.	250Ma	£2/10/-
24V.	575V.	350Ma	£3/10/-
24V.	550V.	215Ma	£3/10/-

VALVES

VR135 .. .. 5/-
6H6 .. .. 3/6
6SH7 .. .. 3/6
7193 .. .. 3/6
VR65A & Socket 3/6
IK5 .. .. 3/6
EA50 With Socket 3/6
EF50 With Socket 7/6
813. New £3/-/-

COMMAND TRANSMITTERS

Excellent Condition.
Complete with Valves and Crystal.

£6/17/6

Command Modulators

Complete with Valves

£2/17/6

COMMAND RECEIVERS

NEW B.C.453

THE Q5ER

£9/17/6

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

SHORT - WAVE CONVERTER FOR BROADCAST SET

Here is a simple unit which when connected between the aerial and your normal broadcast set will provide hours of fun for you from short-wave reception. The only modification required of your broadcast set is the bringing out of heater and high tension voltage for the unit.

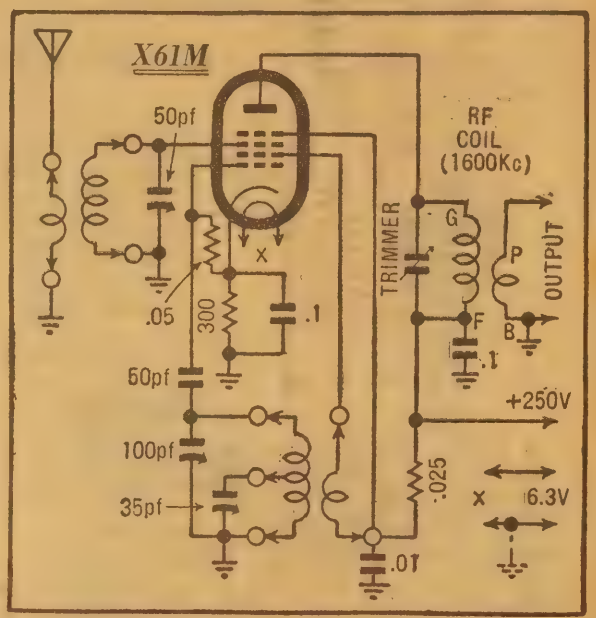
UR contributor, Mr. A. R. T. Turnball, of 73 Holland St., embly, Western Australia, says at he has been using this short-ave converter quite successfully r some time and finds that stations e easily separated and logged witn e aid of a good slow-motion dial. ne converter covers four bands means of plug-in coils.

As in other superhetrodyne units e incoming signal is converted to intermediate frequnecy, which in is case is around 1600 Kc, and is upled to the broadcast set through standard aerial or RF coil tuned this frequency.

The procedure is to set the broad-st receiver dial to a spot around is frequency where it is clear of oadcasting stations. The actual equency selected is not very im-rtant, it could be anywhere be-veen, say, 1400 Kc and 1600 Kc.

Place the aerial on the converter put, connect the converter output the aerial and earth terminals of e set and adjust the trimmer and ug on the converter output coil ntil either a small increase in noise vel is noticed or a short-wave ation, Morse code or otherwise, is ned at best volume. Adjust the nd trimmer across the converter id coil for best volume and the nit is ready to go.

When the converter is used again ith the set, connect them up as entioned and simply tune the oadcast set to the output fre-uency of the converter. The con-



The additional current drain imposed by the converter on the power supply of the broadcast set will be of the order of 10mA on the high tension line and .3A on the heater circuit. Most sets should be able to cope with this extra load without much trouble.

nection between them can be in twisted hook-up wire, light flex or in lightweight coaxial cable.

The power connections can also be in hook-up wire or light flex.

The voltages for the converter can in many cases be picked up from the pins of the output valve in the set. On the other hand, it may be just as easy to remove the chassis from the cabinet and bring leads out through a convenient hole.

One side of the 6.3 volt heater may be earthed but if it is also earthed in the set, make sure that you earth the same side at the converter. Earthing the wrong side would short out the heater winding of the transformer. The same would be true with an earth on the winding CT.

If you earth the heater, the HT minus lead may be omitted.

The controls on the converter are the 50 pf hand trimming capacitor, the 100 pf bandsetting capacitor, and the dial driving the 35 pf bandspread main tuning. This main tuning, tuned over a range set by the bandsetting control for each coil. The 50 pf is adjusted for best volume at various points over a tuning range.

The coil data submitted by our contributor, and given at left shows emphasis on amateur band coverage. However, with appropriate setting of the bandsetting capacitor for each coil, reasonable bandspread coverage of the intervening spectrum should be obtained.

As coil formers are available usually with 6-pin bases only, you will need to identify the aerial and oscillator coils for each band to avoid inserting them into the wrong sockets. The difference in coils for each band is readily evident by the number of turns.

Other converter valves may be used in place of the X61M. For the small changes required in the screen dropping and cathode bias resistors for the ECH35, 6J8G, 6J8GA, these values may as well remain at that shown.

COIL DATA

3.5 Mc.

Aerial coil: Primary 7 turns closewound, secondary 45 turns closewound; Oscillator coil: Grid 22 turns spaced to 1¼in, tapped 15 turns from earth, feedback 6 turns closewound.

7 Mc.

Aerial coil: Primary 6 turns closewound, secondary 30 turns closewound; Oscillator coil: Grid 15 turns spaced to 1¼in, tapped 7 turns from earth, feedback 4 turns closewound.

14 Mc.

Aerial coil: Primary 5 turns closewound, secondary 14 turns spaced to 1½in; Oscillator coil: Grid 7 turns spaced to 1in, tapped 3 turns from earth, feedback 3 turns interwound with lower portion of grid winding.

28 Mc.

Aerial coil: Primary 4 turns closewound; secondary 7 turns spaced to 1½in; Oscillator coil: Grid 3 turns spaced to 1¼in, tapped 1 turn from earth; feedback 2 turns interwound with lower portion of grid winding.

All coils are wound on 1¼in diameter formers with 22-gauge enamelled wire.

All windings are in the same direction.

Aerial coil primary spaced approx. 1-8in from earth end of secondary.

Feedback winding for 3.5 Mc and 7 Mc spaced approx. 1-8in from earth end of grid winding. (Spacing may require adjustment.)

WALTHAM

319-321 Swanston Street, Melbourne, C.1.
393 Flinders Street, Melbourne

Address all correspondence to:
Box 5234, G.P.O., Melbourne C.1.

FOR THE CONVENIENCE OF OUR CUSTOMERS IN NEW SOUTH WALES AND QUEENSLAND, WE HAVE NOW OPENED A BRANCH AT

96 OXFORD STREET, SYDNEY

A cordial welcome is extended to pay us a visit and mail orders will be despatched from this branch in order to allow our Northern customers the advantage of lower freight and postage costs.

COMPASSES TYPE P4

7in dia., 3½in deep. Liquid filled, adjustable azimuth circle. Reconditioned as new £2/10/-

Type P8. Similar in design to above. 5½in dia., x 2½in deep 29/6

Postage and Packing: Vic. 7/3; NSW, Tas., SA 10/6; Qld, WA 14/-.

TYPE 06A

Liquid damped. Adjustable reading prism, complete with torch handle, for standard battery, illuminates card for night use, packed in transit carrying case £7/10/-

Postage and Packing: Vic. 5/-; NSW, SA, Tas. 7/-; Qld., WA 8/6.

TYPE 02B

Liquid damped, card 6¼in dia. x 3½in deep, large viewing prism; ideal for small craft, etc., for normal navigation and for taking bearings £2/5/-

Packing 5/-. Fght fwd.

HIKING COMPASS

Practical compass bakelite case 2½in x 2½in with thumb ring. Calibrated with luminous markings for night use. Invaluable for hikers.
Price £1/9/6

Postage and Packing: Vic. 4/-; NSW, SA, Tas. 5/-; Qld, WA 5/6.

BUILD YOUR OWN ELECTRIC LIGHT AND POWER PLANT

Utilise Your Present Farm Engine to Light Your Home by Installing Our Equipment

AIRCRAFT GENERATORS

Type P1. 30V 200amp suitable for welding £50

12V 500W Type A. New £7/10/-

12V 500 W Type L. New £10/-/-

100V 600 Watt Checked and Tested £15/-/-

24V 1000W brand new Bendix, complete with Double V. Pulley £19/15/-

24V 1500 Watt Checked and Tested £15/15/-

24V 1000 Watt Checked and Tested £12/15/-

12V Cut-outs, for 12 Units 15/-

All Generators 24V and 30V both English and American are suitable for use on 32V Home Lighting Systems without alteration.

3½in Single V Pulleys, splined to fit 12V and 24V Generators £1/15/-

3½in Double V Pulleys, splined to fit 12V & 24V Generators £1/19/6

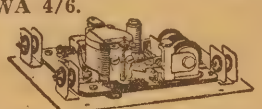
Tandem Generators. Type RLX 12V 750W. 1300 to 1600 Cycles 500W AC, £5 (This model will operate as normal 12V 750W DC Generator without alteration.)

24V Carbon Pile Volt Reg. £1/5/-

50-0-50 Moving Coil Ammeters £2/10/-

30-0-30 Ammeters 35/-

Postage on Cut-outs and Ammeters: Vic. 3/6; NSW, SA, Tas. 4/-; Qud., WA 4/6.



Automatic Regulators and Cut-Outs

MADE BY BENDIX

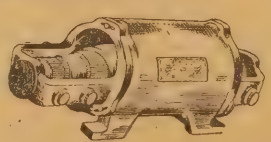
24V and 30V . . . £3/10/-

12V £4/19/6

Also suitable for Tractor Spare.

Postage and Packing: Vic. 5/-; NSW, SA, Tas. 6/-; Qld. WA 8/6.

TYPE 72 GENEMOTORS



These Genemotors can be simply converted to run as a fractional horse power 230V-250V AC Motor, by merely altering the connections. An ideal piece of bench equipment for the handyman and hobbyist. Dimensions: 7in long, 3½in dia. and a 1½in-3/16in grooved pulley is supplied. PRICE 39/6

Postage and Packing: Vic. 5/-; NSW, SA, Tas. 7/-; Qld., WA 8/6.

"WALTHAM DAN"

Send your Name and Addre to: "Waltham Dan," Box 523 G.P.O., Melbourne, and yo will receive regularly a cop of the WALTHAM TRADIN NEWS, which will keep yo abreast of our latest bargai of Disposals Equipment.

Command Receivers

Type BC 453 190 to 55 Kcs £12/10/-.

BC 454 3-6 m/cs £7/10/-.

BC 455 6-9.1 m/c £7/10/-.

Command Transmitter

Type BC 457 4 to 5.3 m/c £7/10/-.

BC 458 5.3 to 7 m/c £7/10/-.

BC 459 7 to 9.1 m/c £7/10/-.

Command Receiver Controls

Type BC 450.

3 Slow Motion Dials.

3 Single Pole Double Thro Switches.

4 Miniature Jacks.

3 Volume Controls, appro 500 ohms.

PRICE £1/15/-.

Postage and Packing: Vi 6/-; NSW, SA, Tas. 8/ WA, Qld. 11/-.

Transmitting Tuning Units

By General Electric

Type TU—10—B
10000 to 12500 Kcs. £2/10/

TU—7—B
4500 to 6200 Kcs. £2/10/

TU—6—B
3000 to 4500 Kcs. £3/10/

TU—9—B
7700 to 10000 Kcs. £2/10/

Transmitter-Receivers

Type RT-34/APS-13

Frequency Modulator appro 450 megacycles.

Valve line-up:
9—6AG5
5—6J6
2—2D 21
1—VR 105

Also contains Dynamotor, i put 27v 1.5 amp, output 28 60 M/A.

PRICE £17/10/-

HERE'S YOUR ANSWER, TOM!

(Continued from Page 51)

be zero because no electrons are
e to flow.
he behavior of the valve there-
e may be represented by a hori-
tal straight line drawn to the
t of the reference point.
Vith the filament operating and
plate voltage applied, no plate
rent will flow. If we raise the
e voltage to 1 unit positive about
nit of plate current flows. This
be illustrated graphically by
rking a point 1 unit to the right
½ unit up from the reference
nt. If with 2 units of plate volt-
applied 1 unit of plate current
vs. Similarly, this can be illus-
ed by another point.

OTTING POINTS

ou can go on increasing the plate
age, noting the corresponding
e current and marking the point
the graph which satisfies both
ues. You will then have a series
oints which go across the graph
some sort of regular fashion. It
reasonable to suppose that the
nts can be joined up into a smooth
ve and that every point on the
ve will represent a plate voltage
its corresponding plate current.
he solid curve illustrates the gen-
shape of the curve for a high
uum diode. You can see that the
ease in plate current is not dir-
y proportional to the increase in
e voltage, but tends to become
ater as the plate voltage becomes
ater.

or high values of plate voltage
can see that increases in plate
age do not cause very much
nge in plate current. This is due
he fact that the cathode is only
able of delivering a limited num-
of electrons.

pure tungsten filament could be
rated in this region of the charac-
stic curve but a thoriated tung-
or oxide coated filament would
liable to permanent damage.

he manufacturer of the valve is
e to supply a characteristic curve,
from this curve you can predict
your valve is going to behave.
circuit can also be designed so
the capabilities of the valve will
be exceeded.

G DIFFERENCE

n the same diagram as the curve
a normal high vacuum diode we
e shown the characteristic for a
ical mercury vapor diode. Note
the plate current increases with
e voltage at the same rate for
plate voltages, then, on reaching
itical value, the current increases
y rapidly for little or no increase
plate voltage. The maximum
rent, however, is limited by the
ode emission just the same as
the high vacuum diode.

When a mercury vapor valve is
d in a practical rectifier circuit it
the advantage that the voltage
p does not increase with the cur-
t load and therefore, provided the
ve is not overloaded, the output
age of the supply will remain
y nearly constant.

hey do have a number of disad-
tages for use in ordinary re-
vers and amplifiers, but are used
ensively in high-powered ampli-
s and transmitters.

Well, Tom, once again we have
en you quite a few ideas to think about. Between now and the next article you would do well to have a good look at various examples of diode valves. In ordinary radio receivers a very popular type is the 5Y3-GT or its equivalents the 5Y3-G and the 80. It includes two diode elements in the one envelope, both with directly heated cathodes.

Type 5V4-G has two indirectly heated diode elements in the one envelope, as have also types 6X5-GT and 6X4. The latter have good insulation between the heater and cathode so that they may be operated at a high potential difference if necessary.

Type 83 is about the most common example of a mercury vapor rectifier. It consists of two directly heated diode elements in the one envelope.

Large mercury vapor rectifiers, such as the 866, are frequently used in transmitting and industrial electronic equipment and are remarkable because of the amount of power they are able to handle in a moderate size. To handle the same amount of power a very much larger high vacuum rectifier would be required and the efficiency of the circuit would not be as good.

TAPE ADAPTER

(Continued from Page 69)

the switch and T-pad components can be slipped into place. When at this stage, all remaining connections can be got at easily.

High tension and heater leads from the set or amplifier are brought in through a rubber-grommeted hole at the rear. Through this same hole is passed the shielded lead which connects to the output of the amplifier.

The connection between the adapter output and the input of the amplifier or set, is through low capacitance PT1M coaxial cable. This is recommended, but if you simply must use shielded hook-up wire, avoid the high capacitance variety. It is a good plan to anchor this cable before it leaves the adapter to avoid twisting off the inner conductor.

The shielded hook-up wire to the heads is taken through a 4-pin miniature speaker plug and socket at the adapter rear.

The audio equipment with which the adapter is to be used should have an input sensitivity of from .25 to 1 volt. If this happens to be the audio end of a radio set, it will need to have pick-up terminals fitted, if these are not already available.

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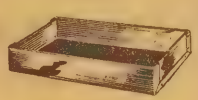

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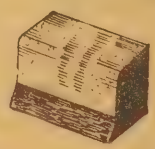

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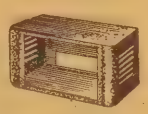

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Mounted on a mast high above The Sun building, this commercial type aerial transformer feeds noise-free signals through 150 feet of plastic light flex to receivers in the very centre of the building. Whereas reception was limited before to a few locals, even country stations can now be tuned during the day.

BEATING THE NOISE PROBLEM

Noise has long been one of the chief bugbears of radio reception and millions of words have been written about it. This article suggests measures which may or may not be worthwhile for those whose radio reception is continually marred by troublesome interference.

by W. N. Williams

NOISE interference with radio reception comes from two main sources—natural atmospheric static and man-made electrical apparatus.

The first of these, we can unfortunately dismiss rather lightly, because there is little that can be done about it. Like the poor, atmospheric noises are always likely to be with us.

Atmospheric noise or "static" is produced by electrical turbulence in the atmosphere which reaches its most obvious form in flashes of lightning.

NOISE PULSES

Such charges, whether visible or not, produce pulses of "radio" energy, which are picked up by radio receivers along with the desired signals. By the time they have run the gamut of the various amplifiers, the detector and the loudspeaker, the pulses are heard as popping or crackling noises, mixed up with the program.

Numerous would-be inventors have devised anti-static gadgets and aerials which purport to discriminate against atmospheric noise. For the most part, they are completely useless. They ignore the plain fact that ordinary broadcast receivers cannot tell the difference between amplitude modulated radio programs and amplitude modulated "static" pulses, which occur in the same frequency range.

When the desired signal is strong—either because the station is close by, or very powerful—it automatically retards the gain of the receiver through the AVC system and the static is not troublesome, unless it, too, is very strong. That is why suburban listeners are never worried by thunderstorms unless they are almost overhead.

When the signal is weak, however, the gain of the set is automatically advanced to receive it and it likewise receives any static that happens to be at large within a radius of possibly some hundreds of miles. (Precisely the same effect obtains with sets having manual rather than automatic control.)

Since both the static and the desired signal originate at a great distance from the receiver, chan in the type and position of aerial cannot markedly favor at the expense of the other. A b ter aerial simply picks up more s nal and more static—and leaves ratio between the two unchanged

Probably the most effective m sure that can be taken against mospheric noise in an ordin broadcast receiver is the fitting an automatic noise limiting detec circuit. While it cannot elimin interfering noises, such a detec can greatly reduce the intensity ear-splitting static crashes.

Noise limiting detectors are wid used in amateur and short-wave ceivers and have been featured several Radio and Hobbies' desig They generally introduce some d tortion on heavily modulated s nals, but this is generally consid ed a worthwhile price to pay hear a wanted program.

Static is less of a problem on short-wave bands, and partly this reason, they are favored long-distance broadcasting. In more remote areas of Austra there are plenty of times when sho wave stations are the only o which are worth listening to.

Frequency modulation also off some protection against the sta

CAN BE AVOIDED

Man-made interference is a v different proposition and does all precautionary steps to be taken many cases.

It is due to electrical spark and/or leakage in man-ma equipment of power lines. It m range in effect from crackling unlike static to a rough buzz noise.

ike static, it is always likely to more of a problem in areas well oved from powerful stations — for the same reason. When signals are weak, the gain of receiver has to be high to re- e them, and this allows any trical interference in the neigh- ood to be picked up and ampli- to good (or bad!) effect.

n some cases, the cause of the rference can be traced without much difficulty.

hus, following a reference re- ly in The Serviceman feature, have had quite a few letters re- ng interference problems arising n home generating sets.

RMAL APPROACH

uch troubles have been cured in e cases simply by earthing the ne of the motor and generator one side of the electrical cir- . Connecting a suitable paper denser across the supply line also s as a rule, any value from ut 0.5 mfd. upward being ade- te.

ne reader found it necessary to h the iron roof of the genera- shed; another found a line filter ful.

racing interference to its source his way and taking appropriate ventative measures is the ideal proper approach, because it es the same problem for all r receivers in the area.

ll kinds of electrical equipment, hines and gadgets are potential erators of interference. Drive ors for farm or industrial mach- y, domestic appliances like uum cleaners and hair-dryers, old e refrigerators, medical appara- and electric signs are to men- just a few.

Where the noise has a distinctive lity, recurring at regular inter- ; the source can sometimes be ked down through some element- "detective" work. You may be to correlate the interference n the next-door neighbor's house- ning activities, with madame's fure, or with welding operations a nearby factory.

ift motors are quite distinctive, ducing a sudden "plop" as the er is applied, followed by a ning noise as the motors gather ed.

I.G. INSPECTORS

he PMG Department maintain a f of experts whose job is to k down avoidable interference suggest methods of treatment. ir aid can be sought in diffi- cases.

ost interference troubles can be ed at the source by fairly sim- measures.

leaning and tightening contacts help eradicate noises due to poor ch operation, or to sparking at s and line terminations under vy load.

n the case of motors and genera- , earthing the frame and bypass- the brushes to ground is the dard approach. Metal clad con- sers are generally preferred for job, with adequate voltage rating a capacitance of .01 mfd. or e.

you are not qualified to tackle job yourself, it can generally be dled by a radio serviceman or an electrical contractor—depending on the nature of the job.

Unfortunately, only a limited number of cases can be treated on this individual basis. There are plenty of instances where radio reception is marred by a steady background of noise which indicates many points of origin instead of just one or two.

There are three more or less standard situations where this arises:

(1) Congested city areas where thousands of electrical circuits and gadgets may exist within a few hundred yards of the receiver, all contributing their own quota of noise.

(2) In country towns where there is sufficient concentration of noise-producing equipment to marr reception of anything but the local station.

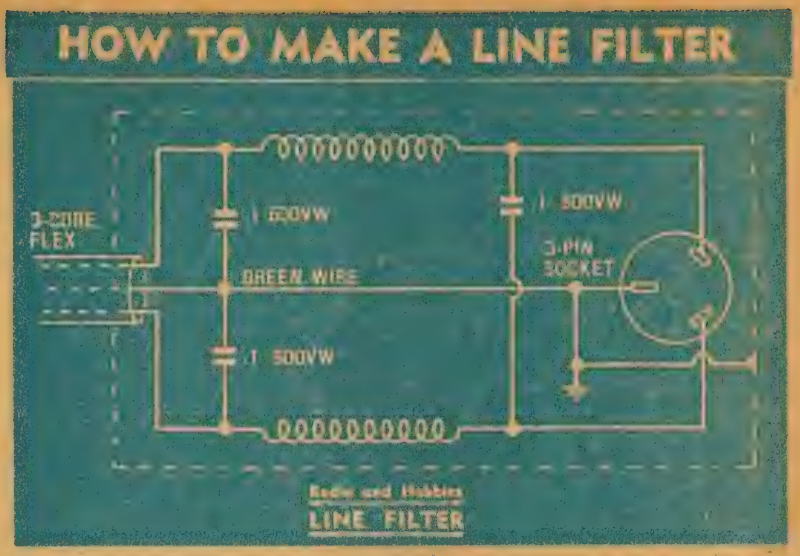
(3) Situations close to high tension cables. Sparking occurs across the insulators when they gather a coating of dust. Seaside towns also get insulator troubles due to salt-spray.

In such cases, it is impractical for an individual to cure the noise at its source, leaving as the only resort that of minimising the noise which reaches the receiver. The measures are aimed at preventing the noise from reaching the receiver (1) via the power mains; (2) via the earth return and (3) via the aerial.

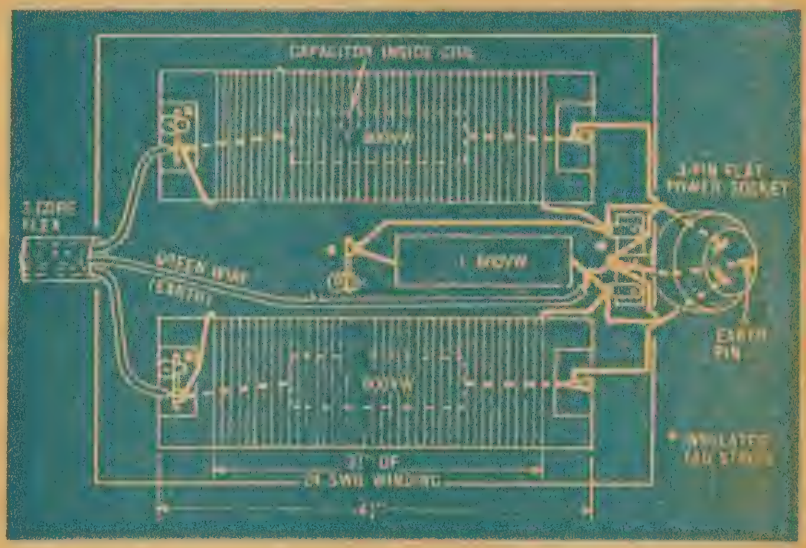
There is no sure way of predicting which of the three approaches will be necessary or effective.

If the interference is still evident when the aerial is removed, it is likely that a line filter will help matters. Conversely, if the noise disappears with the aerial removed, it is likely that it is coming in along with the signals. Such tests are not completely conclusive, however, and the only sure way is to try all the suggestions and note their effect on the signal-to-noise ratio.

Noise arriving via the power mains may originate at a considerable distance from the receiver, but



Circuit details of a line filter suitable for use on an ordinary AC mains receiver. For heavy current applications, the coils would need to be wound with thicker wire.



A pictorial wiring diagram of the line filter is shown above. Readers may care to experiment with different connections to the condensers, as outlined in the text.

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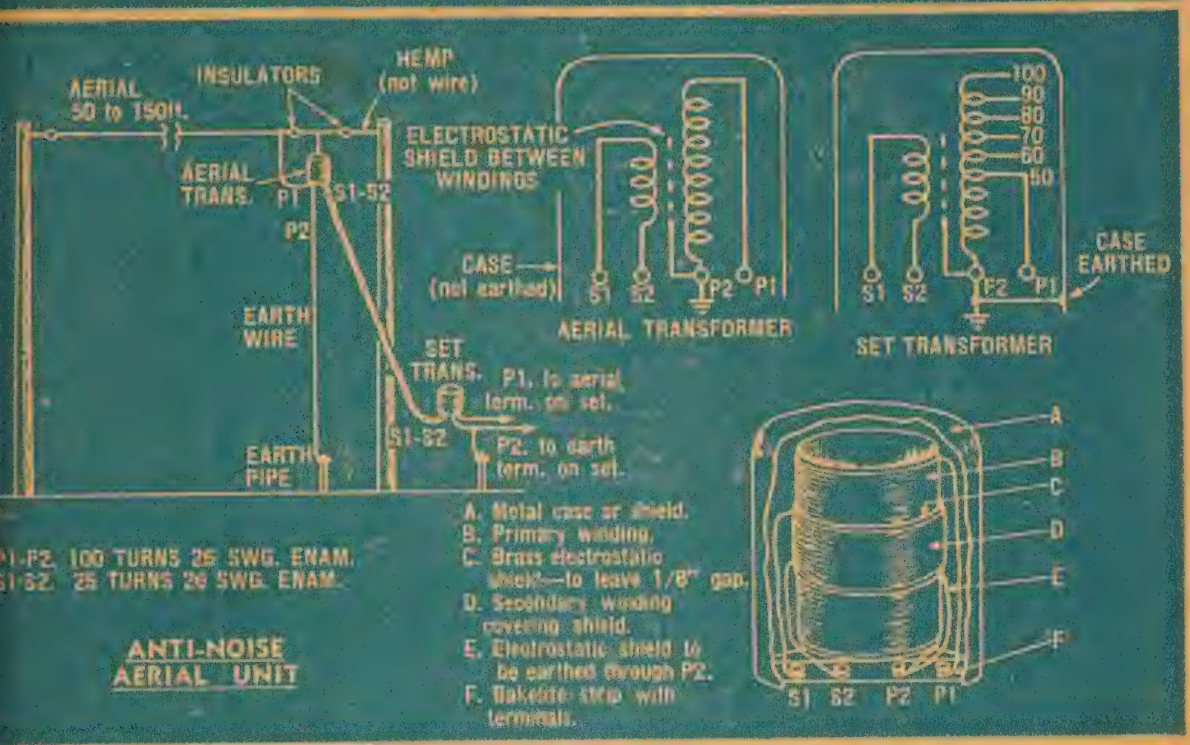
ANTI-NOISE AERIAL SYSTEM FOR HOME BUILDERS



his diagram gives the essential constructional data for a home-made anti-noise aerial system. If desired, the coils may be wound with more turns on smaller diameter formers. Complete anti-noise aerial kits are available commercially.

conducted to it by the mains mselves. The interference may injected directly into the receiver ring, it may be re-radiated and ked up by the regular aerial, yet again, both effects may be parent.

OME-MADE FILTER

n some cases a regular line filter y help, in others it may not. ere is no way of determining this er than actually trying one. You y be able to enlist the co-opera- n of a radio dealer if you are not pared to buy a line filter purely spec".

Alternatively, you can make one for yourself with a little care, l constructional details being en in the January, 1953, issue. For those who may not have the ue on hand, we have reprinted photograph and the wiring dia- m.

The original unit was built in an minium box 5¾ x 4½ x 2in, fit- with a removable lid. Actually y metal box of comparable di- nsions may be used, the import- thing being that it be com- tely proof against tampering by n-technical members of the house- d.

Care should be taken to see that re is no contact between either the mains leads and the box, al- ough the box should be bonded earth via the third pin in the wer circuit.

For safety sake, we have sug- sted tagstrips for all points where incoming and outgoing leads n the coil ends and the bypass ndensers.

The coils in the original unit were wound on a 1½in diameter former, which may be anything from card- board mailing tube to wooden dowel.

Wind one layer of about 24-gauge wire on each former, to a length of about 3½ inches, leaving room at the ends for mounting brackets, &c. The exact gauge of wire and the number of turns is not critical. However, substantially finer wire will produce resistance and heating effects, while heavier wire will mean fewer turns and less effective filter- ing.

The diameter of the coil formers can also be varied, larger formers giving more inductance, but also in- troducing more resistance by reason of the extra wire involved.

HOME LIGHTING PLANTS

The design, as shown, is about right for an average radio set used on the 240-volt AC mains.

For a 32-volt set, the wire gauge would need to be somewhat heavier to avoid resistance losses. By the same token, however, the condensers could have a larger capacitance, and a lower voltage rating.

A line filter installed at the out- put of a 32-volt generator would have to be wound with 14 or 16- gauge wire for obvious reasons. The idea is simply to obtain as much inductance as possible without intro- ducing excessive resistance into the circuit.

If you can spare the time, it is often worth while to note the ef- fectiveness of a line filter with the bypass condensers connected in vari- ous ways. Try it first with the condensers as shown, but it can also be checked with condensers on the input or output ends of the coils only or from all four ends to earth.

Try earthing the filter to the nor- mal power circuit earth or to a separate water pipe earth—or not at all!

Quite apart from its relationship to the line filter, the earth return for a receiver can have a pronounc- ed effect on signal-to-noise ratio.

It does not follow any prescribed pattern, but can only be determined by try-it-and-see methods.

Tune to a weak but consistent signal and check for clearest re- sults (1) with the chassis earthed via the power socket; (2) earthed to a separate water-pipe; and (3) without an earth at all.

The remaining factor is the type and position of the aerial itself— generally the most important of the three possible variables.

The virtue or otherwise of mov- ing the aerial depends largely on the assumption that man-made in- terference is strongest close to the point of origin or to electrical wir- ing connected thereto. It diminishes rapidly in intensity, even twenty or thirty yards away.

BASIC PRINCIPLE

Conversely, radio signals may be regarded as being of fairly constant intensity in any given area. If anything they will tend to be stronger away from the immediate vicinity of overhead wiring.

It follows that an aerial inside the house is in the region of great- est interference and lowest signal strength. The mere act of installing an outdoor aerial is almost certain

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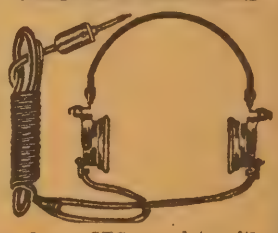

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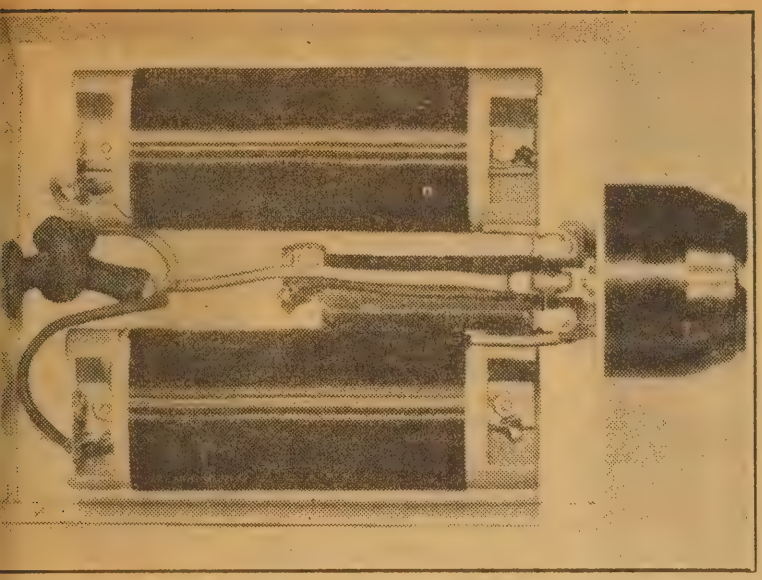


re is the line filter unit with the cover removed. The radio set or appliance plugs
o the 3-pin socket at the right. The flex at the left carries a 3-pin plug to plug
into the house wiring power outlet.

nprove signal-to-noise ratio, be-
e it moves the aerial away
the interference field and into
pen where radio pickup is im-
ed.

other words, the aerial should
t the greatest possible distance
overhead wiring, particularly
tension wiring, and carried to
eceiver by the most direct pos-
route. The higher the aerial
etter it is likely to be.

OTE FROM WIRING

there is a choice of direction,
generally better to have the
l end-on to overhead wiring
r than parallel with it.

many cases, the installation of
od outside aerial will assist
l-to-noise ratio no end but one
us weakness remains—namely,
the lead-in wire can still pick
ignal and it must come into the
ference region.

nsiderable improvement can be
cted in bad cases if the lead-
ire is made purely a conductor
gnals, without itself being able
ck them up.

ielding the lead-in wire is sel-
of any use, because the high
capacitance of a shielded lead-in causes serious losses.

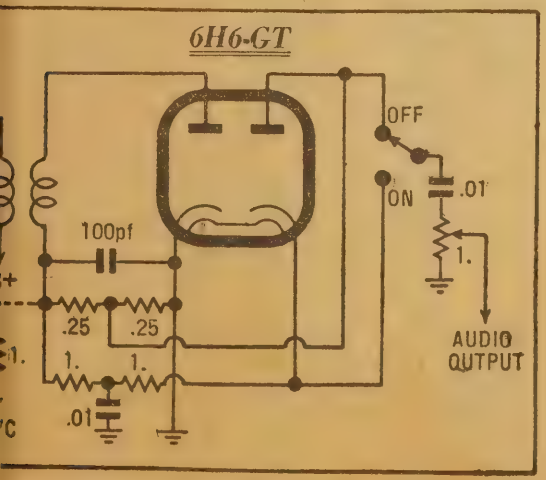
The use of a special dipole aerial with a twin lead-in wire is a better scheme although, to operate effectively, it really requires the use of a balanced primary winding, preferably earthed at its centre and/or shielded electrostatically from the grid winding.

Details of such an aerial system are given for those who may like to experiment with it.

Probably the best general approach, for broadcast band listening anyway, is in the use of a balanced line terminated at each end by matching transformers. Units of this type can be bought commercially, although similar specifications have been available from the PMG Department for 30-odd years.

The scheme is illustrated in the accompanying sketch.

The aerial itself must be erected as high as possible and remote from electrical wiring. Signal currents induced in the aerial flow through the primary of the first transformer and thence to an earth pipe at the foot of the mast. The signals in this portion of the circuit should thus be as free as possible from local



This diagram gives the essential details of a noise limiting detector as used in many R. & H short wave receivers. Simple AVC may be obtained as shown or delayed AVC may be obtained from an additional diode plate in the IF amplifier valve.

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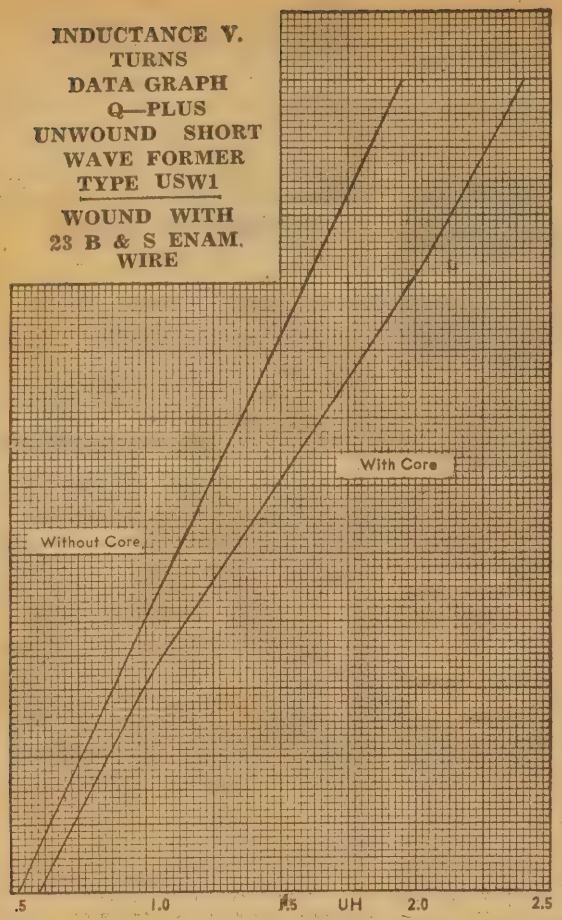

"Q-PLUS" UNWOUNDS S.W. FORMER—TYPE USW1

An unshielded polystyrene former with high frequency iron core terminals and mounting.

SIZE. O/all height 2in (without core protruding). Above chassis height 1¼in.

FORMER DETAILS—Polystyrene. Grooved 16 turns per inch.

MOUNTING—3/16in hole.

INDUCTANCE AVAILABLE—See graph using 23 B & S enamel wire 2.375 uh MA NOTE. If core is left in, a minimum val between the two graphs will be obtaine Heavier wire for the lower values is recom mended and will not materially affect ava able inductance.

23 B & S is optimum size for 16 turns.

R. W. Steane & Co. Pty. Ltd., Auburn, Vi

SUBJECT TO CHANGE WITHOUT NOTICE

"Q-PLUS" MAGNETIC BIAS OSCILLATOR COIL—TYPE OME

PAGE 1

PHYSICAL SIZE. 1 3/8 inch diam. x 2¼in.

PIN CONNECTIONS.
- 1—Grid
- 2—Low 2 output
- 4—Plate
- 5—Low 2 output
- 6—B +

MOUNTING—2 x 1/8in holes (1 3/8in apart)

OUTPUT—Depending on valve, etc . . 2 watts. High, medium or low impedance.

PRIMARY INDUCTANCE . . . 3 MH (in can)

SECONDARY INDUCTANCE 2.4 uH (in can)

FREQUENCY—With .004 ufd condenser—40 Kcs.

REMARKS

A single winding Hartley type oscillator coil for use with 6V6, 6AQ5, or other output pentodes. For lower harmonic distortion these may be triodes.
For circuit recommendations see page 2.

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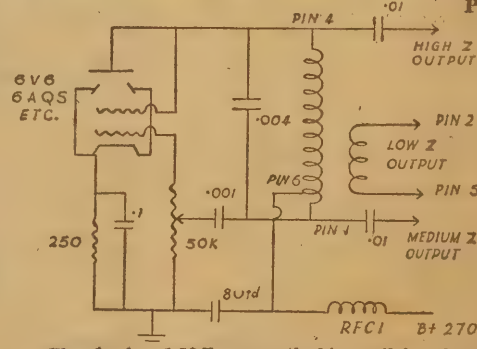
"Q-PLUS" Magnetic Bias Oscillator Coil—Type O

PAGE



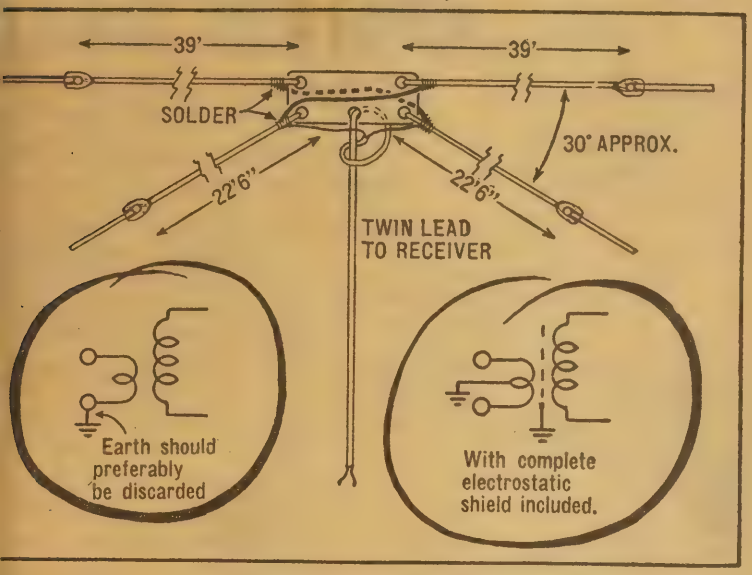
The Q plus O.M.E. magnetic bias coil has been dev oped to provide in conjunction with other compone etc. the supersonic bias voltage needed for tape record and erasing. The circuit provided herewith has b found to beeminently suitable but the following poi should be noted.

1. Greater output may be obtained by using the valve as a pentode—but at the cost of harmonic distortion. To do this merely take screen to B plus. Reducing cathode bias resistor, even to zero, will also increase output but care should be taken in case the valve stops oscillating.
2. B plus should never exceed 330V.
3. High impedance output is taken from plate and earth via .01 ufd. condenser as shown. No load volts at this point should be 200-220 volts (use only VTVM). A load of less than 2500w may stop the valve oscillating. It may be necessary to provide a series resistance with some heads to prevent this. Max. energy from low impedance winding occurs at 10 ohms. Similarly too low a load will stop the valve oscillating.

In order to correctly set the potentiometer the os lator output should be viewed on a C.R.O., and set to maximum output that retains a good sine wave out

The iron core should normally be used in its out most position. It is useful for varying the freque slightly so as to avoid interference effects, particula when using the recorder for recording broadcast ite

ENERAL PURPOSE DOUBLET AERIAL



tails of a general purpose "double-doublet" aerial which is specially suited for rt-wave reception. Erected in the clear, however, and properly coupled to the eiver, the aerial should have useful anti-noise properties on the broadcast band as well. Note the recommended aerial primary connection.

ference, either by radiation or earth currents.
ey are transmitted at reduced dance through the twin plastic to the vicinity of the receiver, re they enter a second trans- er.
gnal currents induced magnetic- in the down leads are in phase tend to cancel, while electro- input is largely nullified by shielding between primary and ıdary windings.

ONDARY CIRCUIT

wever, the signal currents from aerial circuit proper induce re- nt voltages in the secondary of utput transformer and these are ed to the aerial and earth ter- ls of the receiver.
e original PMG specifications, ded for home construction, de- e the construction of the trans- ers as follows:—
ı a 2in diameter former of bake- cardboard or wooden dowelling, a primary winding of approxi- ly 100 turns of No. 26 swg ıelled wire. Suitably secure the and mark the commencing end and the finishing end 'P.2'. y a single layer of insulating over the winding.
t an electrostatic shield of thin 1in wide and of sufficient h to leave a gap of one-eighth inch when it is wrapped around entre of the primary winding. a lead from this electrostatic d and join to 'P.2'. Apply an- layer of tape.
t a secondary winding of 25 of No. 26 swg enamelled wire diately over the electrostatic d. Mark the commencing end and the finishing end 'S.2'. herproof in a suitable manner.
ne set transformer should be ted as close to the aerial and terminals of the receiver as possible, say, underneath the chassis ledge. Leads from 'P.1' and 'P.2' of the set transformer are connected to aerial and earth terminals of the receiver.

"Each tapping on this coil should be tried on the aerial terminal of the receiver until that giving the best results is found. With a set using a magic eye as a tuning indicator this can be quickly determined by tuning in a station on the broadcast band and selecting the tap which closes the magic eye to the greatest extent.

"The construction of this transformer is identical with that of the aerial transformer except that the 100 winding must be tapped at every 10th turn commencing from the 50th turn, and should be wound over the 25 turn winding.

SMALLER UNITS

"Both transformers can be fixed into a shielded can and the terminals brought out. Large coil cans or syrup tins are suitable. The shield should also be earthed."

The commercial units currently available have scaled down these specifications to allow for smaller formers and cans, added to which they probably include special ideas of the manufacturers. However, if you are keen to use a smaller-type transformer, you can try about 190 turns of 30 B & S enamel on a 1½in former, housed inside a 2½ to 3in can.

The low impedance windings would have about 50 turns and the tappings proportioned in the same way as the larger coil.

There is nothing very precise or critical about these figures, the coil simply being designed to be broadly resonant in the broadcast band.

We recently installed two of these

(Continued on page 89)

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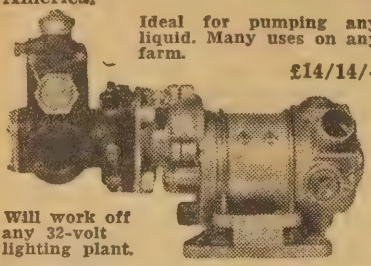

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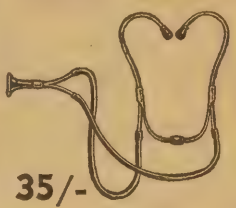
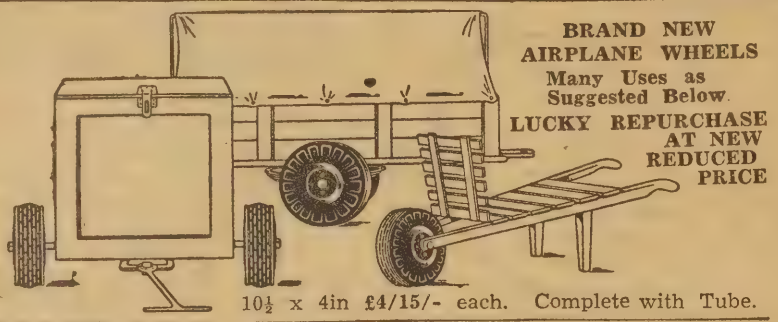


35/-



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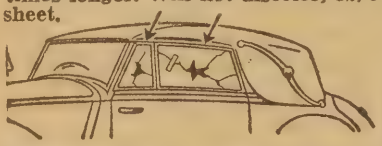

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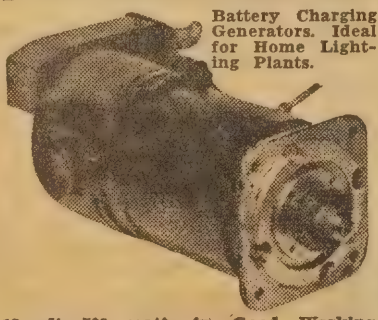

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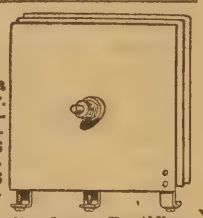

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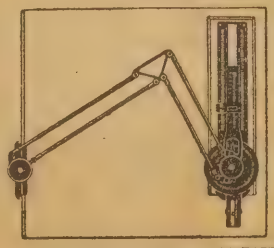

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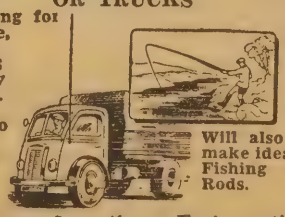

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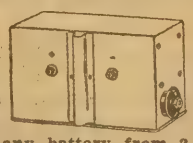

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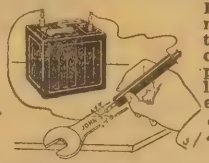

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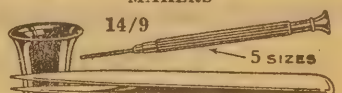

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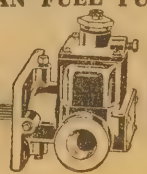

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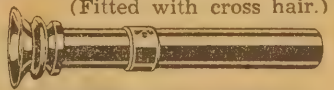
Can be used as a rifle sight. Excellent magnification £4/19/6.
(Fitted with cross hair.)

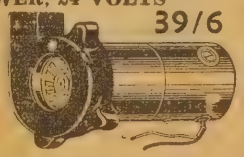


ADJUSTABLE FOCUS.

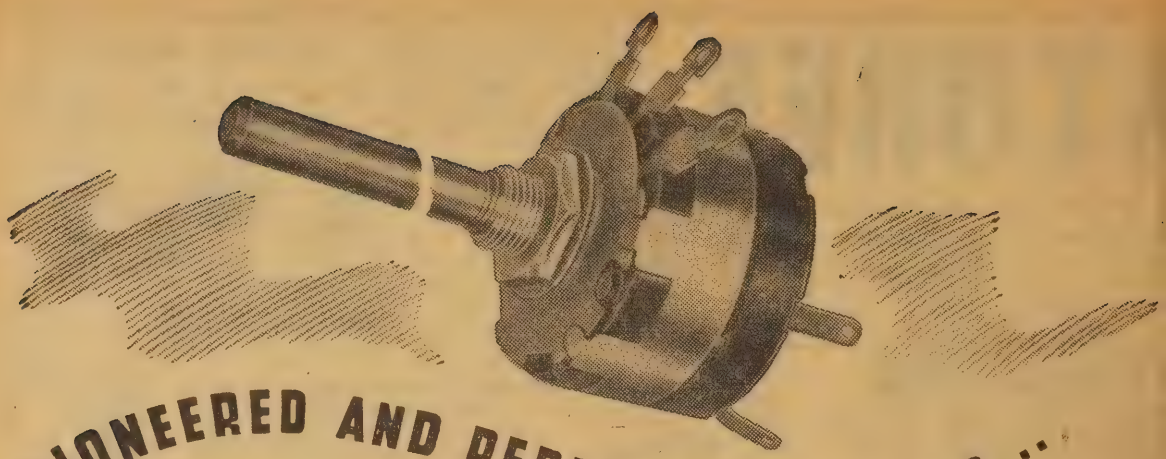
ENGLISH MOTOR AND BLOWER, 24 VOLTS

39/6

Will Work off 32-volt Lighting Plants.



Larger size also available that will work off 12 or 24 volts, £3/15/-.



PIONEERED AND PERFECTED BY I.R.C...

IRC Type CS Controls combine (with other exclusive features) these twin permanent noise-eliminating developments:

1 SILENT SPIRAL CONNECTOR (which completely eliminates noise in controls) is made of special wire—sturdy and durable—and constructed like a fine watch for a lifetime of the quietest service you can imagine.

2 FIVE-FINGER "KNEE ACTION" SILEN ELEMENT CONTACTS. They ride ov the resistance element independently each other, as smooth as glass. There no slide, no friction, no noise.

Noise hasn't a chance with IRC Metallized Volume Controls—they are quiet and STAY quiet. Available with or without switches.

IRC AUSTRALIA

Metallized VOLUME CONTROLS

Sole Agents for Australia:

Wm. J. McLELLAN & Co. Pty. Ltd.

126 SUSSEX STREET, SYDNEY • BX1131

(50 yards from King St., towards Erskine St.)

Calling all Recording Engineers ! !

WE NOW HAVE IN STOCK FOR

IMMEDIATE DELIVERY

THE LATEST IMPROVED MODEL

"GRAMPION" B.B.C. Type Feedback Cutterhead BI-A-GU

(velocity to 21 cm/Sec.)

modified for use with "FAIRCHILD" or similar Hot Stylus Assembly.

ALSO AVAILABLE:

The Original B.B.C. Model Cutterhead

(velocity to 10 cm/Sec.)

To Order: We thoroughly recommend **(for use with either of the above)** Messrs. Grampions' RA3B Driver Amplifier (as the ones supplied to the BBC), and Messrs. Grampions' New lower-priced RA4 Driver Amplifier which has been designed especially for use with the new Modified Cutterhead.

Ask for your BOOKLET containing all relevant details, inc. Amplifier circuits.
"The BBC Type 'B' Disc Recording Feedback Cutterhead and Grampion Recording Amplifiers."
7/6 inc. Postage.

The above complete equipment is at present in use at several leading English and American Recording Studios. It was used for cutting the famous LP recording of **Moussorgsky's "Pictures at an Exhibition".**

For all furtner information contact Sole Distributors for Australia:

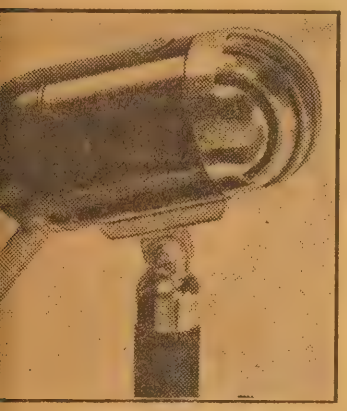
SIMON GRAY (RADIO DIVISION)

28 ELIZABETH STREET, MELBOURNE. Phone Cent. 2813.

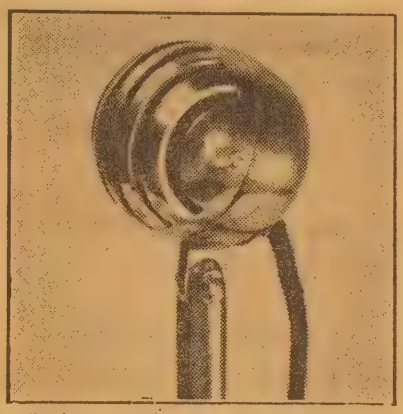
TRADE REVIEWS AND RELEASES

ZEPHYR" SERIES OF MICROPHONES

ephyr Products Pty. Ltd., of 118 Wattletree Rd., Armadale, Victoria ve recently released a comprehensive range of microphones to meet all possible applications from hearing aids to broadcast studios.



series "90" dynamic microphone, ch is supplied complete with 12 feet high grade shielded output cable.



Zephyr crystal microphone type 8XA. It is attached to a short chromium rod which screws to a stand or serves as a hand grip.

BY" of the range is the model -XA crystal insert, which follows re or less standardised pattern is suitable for hearing aids, or tting as a replacement unit into ing microphone cases. It is i with a metallic acoustic filter gives excellent quality on ch. It is suitable also for use wire or tape recorders.

STAL TYPES

ctured on the right is a complete al microphone, model 8XA, h consists of an insert mounted n attractive chromium-plated ing. Zephyr also make crystal ophones available in housings ble for hand use, desk mounting 60-degree coverage for confer-s.

e microphone on the left is the s 90 Dynamic, the latest addition e range. Fitted with a swivel ting and a standard thread, it tended for applications where edness is particularly called for. coil unit is shock mounted an in-built transformer pro- varying output impedance es, different models being avail- for 50, 200, 500-ohm and "grid" circuits.

OCITY TYPE

e microphone can be supplied an acoustic filter where special cteristics are required.

e range also includes two ler dynamic microphones for use and a high quality "series velocity unit for studio use.

sk stands, floor stands and s are available from the same pany, with standard 26TPI ds.

NEW ACOS CRYSTAL P.U.

REPRESENTING a forward step in the design of "turnover" type crystal pickups, Acos have announced this month their new HGP model, incorporating the HGP.33 cartridge. This is a high-compliance type, in which the usual twin cantilever structure has been replaced by two small stylii which protrude from either side of the cartridge. These are ground respectively for standard and L.P. discs.

The new design appears to minimise free resonance effects of the unused stylus and results in a smoother overall response, without obvious treble resonance effects. Nominal output into a 0.5 meg. load is 1V. from 78 rpm discs and 0.25V. from LP discs. The natural response gives a fairly level output from pre-emphasised LP discs and a tapering top response from the older 78 rpm records.

Price of the pickup complete is £5/17/6. However, the cartridge is available separately for £3/17/6 and may be installed in the GP30 type arm.

MAGNECORD TAPE MONITOR SYSTEM

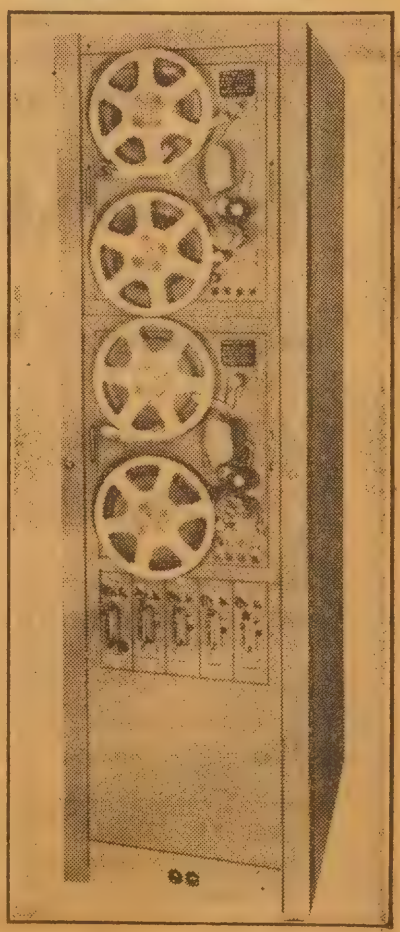
We have been advised by the firm of Magnecord Australasia Pty, Ltd., that they are currently supplying some interesting equipment to the Civil Aviation authorities, not only in Australia but throughout the sterling area.

MOST interesting piece of equipment is the Communication Tape Monitor System for the automatic and continuous recording of radio and phone intercommunication. Purpose of this device is to enable a positive record to be made of all conversations over a particular channel, or group of channels, such as the radio telephone channels between aircraft and control centre.

In order to conserve tape and to provide long running times at a single loading, several interesting features are employed. The tape speed has been reduced to 1⅞in per second and special circuitry employed to enable a response to 2700 cps to be maintained. Two channels are provided on each tape and the system is designed to be controlled by a voice operated relay so that the tape will only be running during actual conversation periods.

The complete unit provides recording for four channels and, although designed by the parent company in the United States, the makers emphasise that the equipment is essentially Australian made and identical with the original design apart from operating voltage.

As well as the above units this firm makes a wide range of tape recording equipment in a variety of styles from portable units to large studio installations.



ANNOUNCEMENT

WE WISH TO ADVISE OUR CUSTOMERS THAT WE HAVE ACQUIRED TH ENTIRE STOCK OF DISPOSALS EQUIPMENT FROM ELECTRONIC EQUIPMEN OF WEST ST. LEWISHAM AND GOODS ADVERTISED BY THEM ARE AVAI ABLE FROM METROPOLITAN RADIO SUPPLIES.

VALVE SPECIAL
NEW 1K5G VALVES IN CARTONS OF 50 £7/10/-

CONDENSERS
OIL FILLED PAPER

8mfd 500vw	10/-	0.5 mfd 3000vw	6/6
4mfd 200vw	3/6	0.25mfd 3000vw	6/6
2mfd 2000vw	20/-	0.25mfd 1000vw	2/6
2mfd 1800vw	20/-	0.1 mfd 3500vw	6/-
2mfd 1000vw	12/6	0.1 mfd 2000vw	6/-
1mfd 2000vw	10/-	0.02mfd 8000vw	4/-
1mfd 1000vw	6/-	0.01mfd 5000vw	4/-

Postage extra.

50-CYCLE A.C. AMMETERS

Range 0-14 Amps.
Scale Size 4in. Dia.
Brand new.
Price, each,
45/-

Packing and postage: NSW 3/-, Interstate 5/6.

BUTTERFLY CONDENSERS
Capacitance range 3-35 microfarad. Size 1¼ x 2¾ x 2¼ inches. Brass plates: Ultra high frequency insulation; ¼-inch shaft.
Price, each **7/6**
Packing and postage: NSW 1/-; Q., T., and V., 1/6; WA, NT, 2/-.

CONDENSER SPECIAL
New Midget Variable Condensers, 19 plate ceramic insulation.
PRICE **4/6**
Packing and Postage: NSW 1/-; Q., T., and V., 1/6; WA, NT, 2/-.

D. C. GENERATORS
12v 750 watt. Ideal Homelighting. Battery charging, etc.
PRICE £5/10/- F.O.R.

SANGAMO PRECISION TIMERS
48-hour jewelled movement. Can be run continuously or for one minute periods. Ideal for photographers, hobbyists, electrical flashes, signs, &c. **22/6**
Packing and Postage: NSW 2/-, Interstate 3/6.

AERIAL RELAYS
Aerial change over relays in metal case (24v) **18/6**
Plus postage.

COMMAND TRANSMITTERS
Type 457 4 to 5.3 m/cs .. **£7/-/-**
Type 458 5.3 to 7 m/cs .. **£7/-/-**
Above complete with valves and crystal.

COMMAND RECEIVERS
Type 454 3 to 6m/cs **£7/-/-**
Type 455 6 to 9 m/cs **£7/-/-**
Type 453 190 to 550 kcs **£9/7/6**
Above complete with valves.

COMMAND MODULATORS
Command Modulators type B. C. 456 containing 1-12J5, 1-1625, 1VR150 relays etc. **£2/17/6**
Genemotors for above input 28V output 575V at 160 mills **£3/7/6**

SCR 522 TRANSCEIVERS
Freq. range 100 to 156 m/cs complete with valves **£24/10/-**
Genemotor supply for above (28V) with filter **£2/15/-**

TYPE 1133 TRANSCEIVERS
Freq. range 90 to 130 m/cs contains 17 6.3 volt valves with plug **£8/17/6**

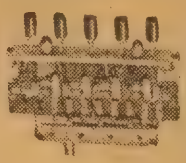
A.T.5-A.R.8 POWER SUPPLY
24 volt genemotor supply containing two genemotors one giving 550 volt at 350 mills and the other 250 volt at 100 mills, also contains filter condensers, relays, fuse holders etc.
£4/10/-

ALL ABOVE PRICES F.O.R.

METROPOLITAN RADIO SUPPLIES

479 Parramatta Road, Leichhardt, N.S.W.
(at top of Taverner's Hill)
PHONE LM3610

PUSH-BUTTON SWITCH



5-pole each 2 of contacts. N in USA. Ideal receivers, m meters, etc.
Price, Each 10
Packing and p age: NSW 9d, terstate 1/6

HIGH-POWER I.R.C. RHEOSTATS
250 ohm, 25 watt.
10 ohm, 2½ amp; 25 ohm, 1 amp.
Price, each 1(
Packing and postage: 9d each

GENEMOTORS

Midget type as illustrated, inpu volts, output 250v at 60mA.
TR1133 type, input 12 volts, o 300 volts, at .24 amps, 150 volts a amps, 6 volts at 5 amps. Filtered 9

NEW VELCO 6-VALVE D- RECEIVERS
240v AC 50 cycle ex-amenities ser Provision for two extension spea Metal cabinet.
Price, each £19/1
F.O.

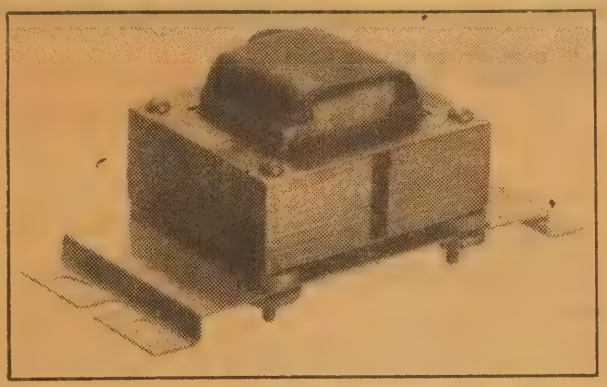
SPECIALS
Dynamic Mike Inserts .. ..
Carbon Mike Inserts .. ..
5 Position Push Button Switches ..
Carbon Mike Trans. .. ..
Throat Mikes .. ..
Cutler Hammer Switches .. .. ..
PMG Key Switches, 32 contact ..
Shielded Hook-up Wire, yard ..
3 Gang Condenser, New .. .. ..
Postage extra.

NEW LUCAS GENEMOTO
Input 12v. Output 250v at 65mA. Input filter supplied £2/1
Postage: NSW 6/6, Interstate 8/

NEW METERS
0-20 mA DC 2½ inch Square Flus English Hobut. Brand new ..
0-.5 amp, RF Thermocouple, Nev
0-3 Amp RF .. ..
0-4 Amp RF Square .. ..
0-30 mA 3 inch Round .. ..
0-20 Volt 2 inch Square .. ..
0-40 Volt 2 inch Square .. ..

OW NOISE FLUORESCENT CHOKE

w chokes for fluorescent fixtures, released by Messrs. Ferguson Transformers, will feature a new anti-noise system of mounting.



ES chokes r fluorescent are always blem, due to very intense etic field n the wind- and lamina- This gives to mechani- um, which is ularly objec- ble in domes- r office in- tions, where prevailing is low.

popular od has been l the chokes tch inside an outer can, but method tends to be both cum- me and expensive, apart from there arises the problem of radiation.

gusons have found that lamin- hum can be largely eliminated recision assembly and impreg- n, but overall vibration is often mitted and amplified by the ces of the lighting fixture it-

eliminate this trouble, the is now mounted by rubber es to a pressed metal bracket, racket being shaped and drilled it many popular fixtures.

e choke illustrated above is the att ballast but a 20-watt ballast is available in the same design Supplies are available through distributors in all States.

New UCC capacitor

A metal-clad addition to their range of electrolytic motor start capacitors is announced by the United Capacitor Co. Pty. Limited, of Enfield, NSW.

To be known as the "Aliclad" type ED, the new capacitor has been designed for easy attachment to the motor and is enclosed in an aluminium can for protection

"Aliclad" electrolytic motor start capacitors are available for operation at 150 V. and 240 V.

THE NOISE PROBLEM

(Continued from Page 83).

aerial systems in the large city building where our offices are housed. The aerials were run to flagpoles 20 or 30ft above the prominences of the building and the local earth made to the nearest available plumbing fixture.

The lead-in wires were approximately 150ft in length, running across roofs, down a light well and thence through various inside partitions.

The improvement in performance, however, was little short of amazing. Whereas, with makeshift aerials, the weaker locals were right down in the noises level, all were completely free from noise with the new installations. We were even able to play the Katoomba and Wollongong stations for good measure!

One slight modification had to be made later to the installation, however, to avoid wind damage.

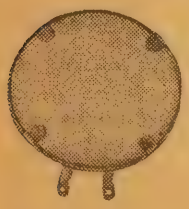
The top transformer was strapped to the mast instead of being hung free, as in the diagram. The earth and lead-in wires were fixed, run down the mast into the less windy zone. Finally, we carried the lead from the aerial to the transformer via a fixed insulator to avoid movement and ultimate fracture at this point.

The installation involved us in some extra work and expense but it has proved abundantly worthwhile.

But that is the way with interference. If you are not prepared to put up with it, you must be prepared for a special effort to combat it.

AUSTRALIAN MANUFACTURERS MEET THE DEMAND—ANNOUNCING THE NEW ZEPHYR "MODEL IXA" CRYSTAL INSERT

ZEPHYR

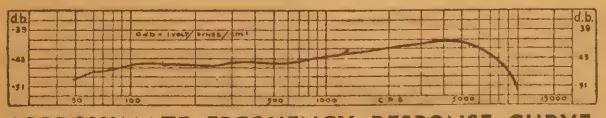


1 13-16in dia.

⅜in

1⅛in dia. (Rear)

AVAILABLE FROM ALL RADIO STORES



APPROXIMATE FREQUENCY RESPONSE CURVE

- **Australian made throughout**
- **Patented crystal unit guarantees outstanding efficiency and performance.**
- **Protected against ingress of moisture with approved moisture sealed crystal element.**
- **Small — compact — lightweight — durable.**
- **Will not blast from close speaking.**
- **Precision engineering ensures realistic reproduction and high output with long life and dependable operation.**
- **Good high frequency response ensures excellent speech reproduction.**
- **Aluminium diaphragm mechanically protected and frequency controlled by "Zephyrfil" filter.**

If unable to obtain from your Dealer write direct to:—

ZEPHYR PRODUCTS PTY. LTD.

118 WATTLETREE RD., ARMADALE. SE3. VIC.

PRICE 57/6 RETAIL

IMMEDIATE DELIVERY

SOLE DISTRIBUTORS OF ALL ZEPHYR MICROPHONES AND ACCESSORIES

TRADE INQUIRIES INVITED FROM MANUFACTURERS & WHOLESALERS

SHORT-WAVE NOTES BY ART CUSHE

NEW INTEREST IN BBC RELAYS

Reception of the Coronation and cricket broadcasts are being well received through the relay link at Singapore operated by the British Far Eastern Broadcasting Service.

PROVIDING a link with Britain, when direct reception was not possible, the BFEBS gave listeners in Australasia excellent coverage of the Coronation service, and the many BBC features which took place on June 2. Reception during the Coronation was best on 7260 Kcs, with secondary coverage, while the speech by Her Majesty at 6 am signals were good on 7120 Kcs. These frequencies suffered little interference.

The forthcoming cricket Tests will also be rebroadcast by Singapore for listeners in Australia and New Zealand. The schedule is:

8.15 pm-10.15 pm—11820 Kc.
8.15 pm-3.45 am—9690 Kc.
12.45 am-3.45 am—7260 Kc.

Reception is expected to be good until the last 90 minutes of play, when the ideal frequency would be an outlet in the 49-metre band.

Tests in May between the BBC and our listening post, showed that both 49-metre band frequencies, which are assigned to the British Far Eastern Broadcasting Service, Singapore, are unsuitable for reception here due to severe interference. These frequencies are 6110 and 6175 Kc.

The BBC may "borrow" a frequency from the ABC in this band, to provide coverage during the last portion of the cricket Tests, because of the falling off of the 31-metre band signals. Reception in Singapore will be received from the BBC on 17890 and 15260 Kc. These two BBC transmitters will carry the ball-by-ball descriptions without interruption.

VOICE OF GERMANY

FOLLOWING mention last month of the new German Overseas Service, we have been hearing the German station, closing at 2.30 pm, with an English announcement. The frequencies used are 6270 and 7290 Kc, and when closing they announce "This is the Voice of Germany, broadcasting from Cologne. We have been broadcasting to North America on 7290 and 6270 Kc, over transmitters of the Broadcasting Stations of the Federal German Republic. We operate daily from 2.30 to 5.30 am, Central European time."

ZJV, SUVA

ZJV, SUVA, has made a further frequency change, and is now operating on 3980 Kc in the 75-metre band. Signals through the transmission, 3.30-8 pm, are very good, and this lower frequency seems to provide better coverage, and the interference is only slight on the channel. ZJV is now verifying with a new verification card. This shows a native with the traditional bowl between his knees mixing one of Fiji's well-known tropical drinks. The card is a light cream, with the call "ZJV Suva" and details on the broadcast band transmitter's power and frequency, which is 2000 W on 930 Kc.

BEC26—TAIWAN

VERIFICATION from the Military Broadcasting Station, Tsoying, Taiwan (Formosa), lists the frequency as 10080 Kc, and schedule 8.30-9.30 am, 1-30-3-30 pm, 7 pm-midnight. The verification letter is in English, from Chan Shik Chieh, Director. BEC26 provides a strong signal from the opening at 7 pm.

THE new Radio Baraquisimeto outlet, YVXJ, which we mentioned last issue, has verified with a letter, in only 16 days. The letter lists the two short-wave stations of "Radio Baraquisimeto" YVMQ (4940) 4000 watts, and YVXJ (9510) also 4000 watts. The letter states that YVXJ is the only Venezuelan station operating in the 31-metre band. The address is Apartado Postal 76, Baraquisimeto, and the verification signer is R. A. Segura, president.

NOTES for the next issue close on July 12th, at 212 Earn Street, Invercargill, NZ. All times are Eastern Australian.

FROM THE MAILBAG

VERIFICATION received this month included our 1000th broadcast band verification, and with our 1600 on short-wave, gives us a somewhat unique record of over 1000 verifications on both broadcast and shortwave. TIDRC, San Jose, Costa Rica, confirms reception with a folding card, one half showing a local colored scene of a dance in progress with a marimba player the main feature, while the other half lists station details, and verification of reception. TIDRC operates on 9615 Kc, with 4000 watts, and the address is Apartado 3611, San Jose, Costa Rica. OTM, Radio Congo Belge, Leopoldville, verifies by airmail with a letter from the manager, Mr. K. Theunissen, PO Box 3171, Leopoldville. Transmission for European listeners are 3-4.30 pm, 8.15-10.30 pm, 1.30-7 am. They use: OTMI (6295) using 3000w, 800w, 3000w, for each transmission in that order; OTM2 (9380) 20,000w for first transmission, 50000w for last transmission; OTM4 (11,720) 50,000w for second transmission. Local programs are carried on OTH (9210), 20,000w, 8.30-10 pm, 2.30-4.30 am, and OTH (11670) 20,000w, 2.30-4.30 am.

DIGEST OF DX TIPS

Kcs.	Call and Location	Times Heard (AEST)
3305	Radio Jamaica, Kingston.	Opens 8.00 pm (new frequency).
3980	ZJV, Suva, Fiji.	3.30-8.00 pm.
5020	HJFW, Manizales, Colombia.	Closes 3.00 pm, Sunday.
6090	Radio Luxembourg, Luxembourg.	3.40 pm-12.30 am, 1.45-9.00 am.
6130	VLT6, Port Moresby, New Guinea.	Fair signal at 7.00 pm.
7670	Radio Bulgaria, Sofia.	English news 6.00 am.
9368	Madrid, Spain.	1.05-1.45 pm, in English.
9562	OAX4Z, Lima, Peru.	Sign off 2.58 pm with English.
9720	HI2T, Trujillo, Dominicana.	Sign off 3.00 pm.
9760	TGWA, Guatemala City.	Dance relay to 4.00 pm.
11950	YSAX, Managua, Nicaragua.	Sign off 4.00 pm.

FLASHES FROM EVERYWHERE

4VGS, LA GONAIVES, HAIT another of the many new Central South Americans, this one being hea our good friend Marvin Robbins, of In apolis, Ind. 4VGS uses the slogan, " Independence," and is running just 400 watts on 6340 Kc. Antenna is a 7 tower. They are being reported in America at 1 pm. A further Haiti st 4VWA (6300), "Radio Citadelle," menced broadcasts in 1950, and several frequency changes, moved t new outlet in February. Transmitter watts, and antenna a half-wave dipole on top of a two-storey bui giving a height of 55 feet.

NEW COSTA RICAN transm TIHV, Apartado 341, San Jose, is a s we have been hearing on Sundays t off at 3 pm. Signals are fair, but ference is rather severe from RIAS and YSS (6010). TIHV announces "En de Radio Cristal en San Jose," and callsigns as T1HV on 6009 Kc; and T on 1300 Kc. Universal DX Club repo further new station which announc "Radio Excelsior" on 6508 Kc.

ECUADORIANS on 60 metres are viding some good signals in the after and some have been heard, too, after HC1MI (4840), "Radio Gran Colo Quito, closes at 2 pm but on Sunday been heard until after 3 pm with broa directed to relay stations in Guayaqu Riobamba. HC4AS (4730) and H (4705) have both also been heard c at 2 pm.

NEW BRAZILIAN TRANSMITTERS operating include "Radio Cultura de A quara," using the call ZYR60 on 247 "Radio Emissora de Piratininga," Paulo uses two 50 Kw transmitters, (9635), ZYR65 (11745). PRD23 ("Emisora Continental," Niteroi, is a station under construction, accordi World Radio Handbook.

BBC FREQUENCY CHANGES in the moving of some transmitters in gular bands. GVO to 17890 Kc from GSR (25720) from 26400, GSS (25840) 26550. A new frequency is MCT (1

ARGENTINA'S SPANISH SERVIC been noted on a new frequency, 119 at 8 am. SIRA transmissions in E are now broadcast on LRS (11880) 6- LRA (15345) 9.5-11 am, and LRU (noon-3 pm.

OUR congratulations are extend to Mr. Cushen following his rece of a Coronation medal. The aw was made in recognition of his w intercepting and relaying prison of-war information during the war.—ED.

NEW 50-KILOWATT TRANSMITTE Thailand's Overseas service is expect be in operation soon, reports Radio tralia. The transmitter will direct grams to several areas. The present s ule of Bangkok is: 8-9.15 pm Englis HSK5 (6340) 1000w, HSK7 (11910) HSK8 (15640) 250w. The Home Serv relayed 9.45pm-1 am, on the above quencies, with an additional one, 71(

RADIO NACIONAL DEL PERU, the Government-operated station, present providing strong signals fr early as noon to sign off at 2.58 pm an English announcement. The s operates on both 5880 and 9562 Kc when closing, states they are to o from 11 pm on 9562 Kc only. The a is Radio Nacional del Peru, Avenue Thours 441, Lima, Peru. The transm are one of 50,000 watts and the other watts.

THE HAM BANDS WITH BILL MOORE

The Radio Amateur Civil Emergency Service in the US is a new departure in amateur organisation—new from two angles. Firstly, the licensing authority, the FCC, holds a degree of control on its general organisation and, secondly, it is a venture into a field which will provide amateur radio activity during war.

ES — Radio Amateur Civil Emergency Service—is an entirely new ture in the USA in amateur radio isation and will provide amateurs a definite job in civil defence in vent of the outbreak of war.

some years now, the scheme has under discussion, and it was apt that the War Emergency Radio ce (WERS) of World War II, work- conjunction with the ARP, had a er of shortcomings. It lacked exnced personnel (it was formed a after the outbreak of war), the fre- bands available (2½ and 1¼ metres) have been extended for effective tion, and the service should have exclusively amateur.

L DEFENCE IN USA

Federal Civil Defence Administrain conjunction with the FCC, have ally arranged the scheme, and early 51 the FCC set aside the following encies for RACES operation:—
-2000 Kc (subject to existing Loran ctions).
-3510 and 3990-4000 Kc (two 10 Kc).
-28.75 and 29.45-29.65 Mc (two 200 ands).
-50.75 and 53.35-53.75 Mc (two 400 nds).
17-145.71 and 146.79-147.33 Mc (two c bands).
225 Mc.

proposed rules of RACES were ted in November, 1951, by the FCC. were finally released in the middle 52 after incorporating some of the stions offered by individuals and ies.

gh thought has been given to the e recently, and a number of amawas concerned with the assigning ateur frequencies for RACES work- They felt that frequencies outside bands would have been made avail- These RACES frequencies would n the event of war, exclusively S.

ing RACES practice drills it is that amateurs generally will co- te in clearing RACES segments. It ter all, a temporary service and only operate during any emer- .

s anticipated that 25,000 amateurs be available for RACES working e of war, but it is estimated by the that 200,000 persons would be re- to implement the full program.

SOLELY AMATEUR

s apparent, then, that the service t be kept exclusively amateur, that ts will have to come from commercence holders, while others would to be trained by amateurs to fill any vacancies. These recruits would act as operators and on associated

ion equipment would still be the nsibility of the amateur.

RACES organisation in any area be under the control of a radio . RACES is not casual ham radio y during wartime; it will be offi- controlled and strictly dedicated blic service.

RACES organisation can only around an existing civil defence sation. The first essential in any is to organise an effective local and amateurs may have to work e general scheme before RACES ion is possible.

Civil Defence Director responsible neral organisation will need a comations officer (he could possibly e the recognised RO), he could be a prominent amateur, a retired army or naval officer, or perhaps the communications chief of the local municipal services.

RACES does not become automatically a section of any CD project. Those in the project may think existing communications nets would be satisfactory. Amateurs will then have to sell their RACES organisation to the CD people. If, in the past, amateurs have been conducting an emergency net, their record in that field would assist, in fact in many cases the local emergency net has formed the basis of the RACES system.

In the FCC regulations the Radio Officer (he is certified by the FCC) is responsible for the details of RACES operation. The whole RACES proposals have to be approved by the FCC and authorisations to operate arranged.

In conjunction with CD plans, RACES proposals have in most cases to be approved at State civil defence level and the FCDA have promulgated a suggested nationwide allocation of RACES frequencies.

AUTHORISATIONS

Station authorisations are available to all classes of licencees except Novice and Technical, but will only be granted if the plan has been filed and approved by the FCC. A number of RACES organisations have community-owned equipment and it is normally arranged that the Radio Officer obtains a special licence to cover such apparatus. No licence will be issued by the FCC for RACES working exclusively.

The whole RACES organisation is complex compared with previous field organisations, so many authorities have some say in its working, but it does provide any amateurs contemplating similar plans with many ideas.

USE OF 80M BAND

It is a pity that greater use is not made of the 80-metre band during daylight hours. During this winter a few more stations have been active, but full use is not being made of facility of all day contacts up to 200 miles.

Even at midday, propagation conditions allow contacts at good distances. Operation on this band allows stations to cut away from the QRM and unstable daylight conditions of the 7 Mc band.

One schedule running at 1030 hours on 3.5 Mc/s has never failed in three years, the distance just over 100 miles, and signals generally run at S8 to S9. One station uses only 12 watts input.

Despite the possibility of BCI and electrical noise in some locations, further interest could be shown in daylight operation on 80. If sufficient stations operate the band will prove very useful, even allowing the UHF gang to line up their transmitters for extended ground wave working.

Another certificate available for the DX-minded is the WPR (Worked Puerto Rico) award.

Two types of certificates are published the "25" or "50" type, and will be issued to stations who can produce confirmations from either 25 or 50 KP stations. These cards should be forwarded to the Puerto Rico Amateur Radio Club, PO Box 3533, San Juan, PR. A self-addressed envelope should be included for the return of cards.

Contacts made with bona fide KP4 stations may be counted for WPR certificates regardless of whether made with fixed, portable or mobile equipment. This gives a possibility of three separate confirmations from the same KP station.

WIRELESS INSTITUTE QSL BUREAUS

The function of the WIA QSL Bureau system is to expedite the delivery of QSL cards from other parts of the world to Australian amateurs. In reverse it works to distribute Australian cards to stations throughout the world. Cards are normally sent via the official QSL Bureaux run by the National societies. The bureaux are listed periodically in the IARU notes in QST and other amateur radio magazines.

Volunteer officers run the service operating in all States, and it caters especially for WIA members. During the past few years the number of cards handled has fallen, due to the poor DX propagation conditions, but an improvement should be noted in the next few years.

Cards for city members of the WIA are normally picked up at meetings, while country members' cards are sent out at intervals. Inwards cards are handled free, for outgoing cards a charge of ½d per card is normally made (some State divisions make no charge for outgoing cards for VK districts).

NON-MEMBERS

Non-members' cards are generally available from the bureau if a stamped, self-addressed envelope is forwarded to the respective address.

The following are the Federal and State QSL Bureaus and the officers in charge. Some of these gentlemen have been serving in these positions for 20 years and more.

Federal QSL Bureau: R. E. Jones, VK3RJ, 23 Landale St., Box Hill, E11, Victoria.

VK2 QSL Bureau: J. B. Corbin, VK2YC, 78 Maloney St., Eastlakes, Sydney. (Inwards and outwards.)

VK3 QSL Bureau: Inwards — Graham Roper, VK3ZB, 26 Lucas St., South Caulfield, Vic. Outwards—Frank O'Dwyer, VK3OF, 190 Thomas St., Hampton, S7, Vic.

VK4 QSL Bureau: Jack Files, VK4JF, Vanda St., Buranda, South Brisbane. (Inwards and outwards.)

VK5 QSL Bureau: Geo. Luxton, VK5RX, 8 Brooks St., West Micham, SA. (Inwards and outwards.)

VK6 QSL Bureau: Jim Rumble, VK6RU, Box F319, Perth, WA. (Inwards and outwards.)

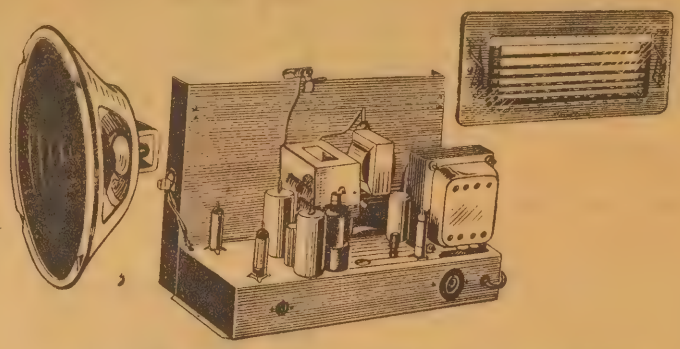
VK7 QSL Bureau: Inwards—T. Allen, VK7AL, 8 Thirza St., New Town; outwards, Ray Calvert, VK7RT, 310 Park St., New Town, Tasmania.

RSGB RELAY

The Radio Society of Great Britain conducted, during June, a Coronation relay on similar lines to the loyal relays of the early 1930's. When His Royal Highness The Prince of Wales, KG (now HRH The Duke of Windsor, KG) was patron of the RSGB, birthday greetings were conveyed to him each year. Messages were originated by amateur organisations and relayed to the RSGB via British amateur radio stations.

This year's relay arranged by the RSGB Council is the first of its kind ever organised, and National and local radio societies throughout the British Empire originating messages to reach the headquarters before June 2.

The WIA originated messages on behalf of radio amateurs in Australia. Herb Bartlett, G6QA, was responsible for the organisation of the relay.



ASSEMBLE YOUR OWN RADIOGRAM

Using the following basic parts:

Chassis complete with 12in Rola Speaker as illustrated, Plastic Dial Scale, Knobs, pick-up Lead, etc. This 5-valve dual-wave chassis uses the latest Radiotron miniature valves, the best brand of components and gives exceptional performance plus reliability. It measures only 13 inches long by 6 inches wide by 8¾ inches high overall and will easily fit into any console or radiogram cabinet.

PRICE £29/10/-

SPECIALS!

(1) Rheostats 100 ohm Heavy Duty type, as used in Aircraft. Price 2/3 ea.

(2) Rheostats. 250 ohm Heavy Duty mica and porcelain insulated. Price 4/6 ea.

(3) Tru-trak Magnetic Pick-ups are sensitive and have good tone. Worth 57/6. Our Price 10/9 ea.

(4) German High Impedance Headphones 4000 ohms impedance, are adjustable and well worth £4/10/-. Our Price 39/6 ea.

(5) English Low Impedance Headphones as used by Army; with cord and plug. Brand new and boxed. Price 18/6 ea.

(6) 29 B & S Enamelled Wire in 2lb and 3lb reels. Price 2lb reels 9/- ea. Price 3lb reels 13/6 ea.

(7) .5 mfd 8000 Volt Test Oil Filled Condensers. Price 4/6 ea.

(8) .1 mfd 4000 Volt Wkg Block Condensers. Price 4/6 ea.

(9) 5BPI Cathode Ray Tubes, new and boxed, sacrificed for 19/11 ea.

(10) Sockets to suit 5BPI. Price 8/6 ea.

(11) VCR97 English 6-inch Cathode Ray Tubes Price 38/6 ea.

(12) Vernier Drives suitable for instruments, small portables and Mantels, Car Radio, etc. Each control fitted with indicating pointer. Will fit on ¼in shaft. Worth 12/6. Only 7/6 ea.

(13 Record Players. This attractive unit in leatherette covered case uses well-known English Motor and a good English magnetic pick-up. Motor can be used at either 78 R.P.M. or 33 R.P.M. (The change-over is effected by reversing drive-bush). Available in Grey, Brown or Black Leatherette. Worth £18/10/-. Our price £9/10/-

(14) 2-gang .0001 Condensers standard size suitable for short-wave receivers. Our Price 4/6 ea.

(15) Carbon Pots. Miniature 30,000 ohm type ideal for tone controls. Price 1/3 ea.

(16) Carbon Mike Inserts, miniature size suitable for home broadcasting experimental work, etc. Price 2/9 ea.

(17) Speaker Transformer Windings available for the following Speakers Old Saxon, New Saxon, Midget Rola, Standard Rola, etc. When ordering state the valve you wish the winding to match and we will supply the correct one. All one price 3/9 ea.

(18) Indicator Lamps made of black bakelite with red or clear glass. These are ideal for instrument panels, tail lights on trailers, etc. Screw-in torch globes fit into these lamps. Worth 5/6. Our Price 1/9 ea.

(22) 14 Henry 60 ma Chokes well-known make. Worth 13/9. Our Price 9/- ea.

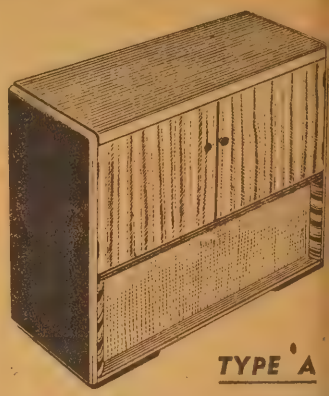
(23) Class B. Audio Transformers. Usual price 22/6. Our Price 12/6 ea.

(24) Car Radio Vibrator Transformers, 6-volt to 250-volt. Should be 39/6. Our Price 17/6 ea.

(25) Car Radio Vibrator Transformers, 12-volt to 250-volt. Should be 39/6. Our Price 17/6 ea.

NOTICE

All parcels sent registered post unless otherwise stated. Postage or freight must be included with order.



TYPE 'A

RADIOGRAM CABINET

Two styles of Radiogram Cabinets a available (as illustrated).

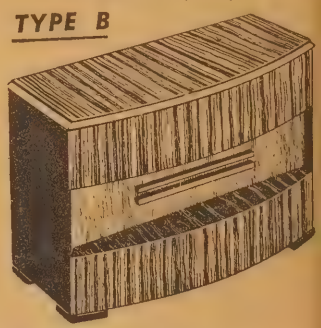
Type "A" Flat type, front openi style, available in Walnut, Mahoga and Blonde.

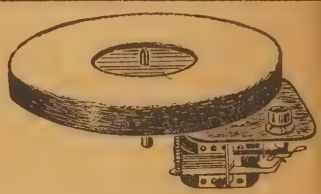
Price £16/10/-

Type "B" Lift-up Lid, Bow front sty in Walnut Veneers.

Price £15/10/-

TYPE B





MOTOR AND RECORD CHANGER TO SUIT

Single Unit Motors (as illustrated) speed type suitable for Standard a Microgroove Recordings.

Price £5/10/-

Turn-over head Crystal Pick-up suit above motor.

Price £5/10/-

3-speed Motor and Turn-over He Pick-up on unit plate with speci mountings, etc. Goldring G.U.4.

Price £14/14/-

Single Speed Paillard Record Changer Swiss made, Brand new and boxe

Price £8/17/6

3-speed B.S.R. Monarch reco changers, latest type with Turnov Crystal Head.

Price £26/10/-

MOTOR SPARES LTD.

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Melbourne

BRANCHES THROUGHOUT VICTORIA AND RIVERINA

W.I.A. NEWS

annual meeting of the NSW Divi-
n. of the WIA was held on May
nd president John Moyle, VK2JU,
od the chair. After the disposal
normal routine business a lecture
presented by Arthur Thurston,
V, on "Solders and Soldering"
is a metallurgist and in his own
style brought out many interest-
ints on the function of solders. It
ubject not often covered by lec-
and all present learnt much on the
oints of the art.

results of the elections for coun-
1953-1954 were announced at the
ion of the meeting. The seven
iors elected were as follow: Wal
K2XU; Jim Corbin, VK2YC; Dave
K2LO; Stan Bourke, VK2EL; Roy
VK2IV; George Bruce, VK2GT;
Oakes, VK2FA.

subsequent meeting of the above
l the following offices were filled
e ensuing year:—

ident, Jim Corbin, VK2YC; vice-
nts, Wal Nye, VK2XU, and George
VK2GT; secretary, Dud Millen
Q. It is anticipated that he will
isted by his wife Joyce, VK2MI, an
nt stenographer; assistant secretary,
ewis, VK2YB; librarian, Dick Dowe,
; UHF liaison officer, Bob Winch,
A. All matters pertaining to
ur Radio will now be handled by a
ttee of three, Naughton Macnaugh-
K2ZH; Peter Vesper, VK2PV; and
Anderson, VK2AND. A number of
ns have yet to be filled and will
ed at a later date.

VHF SCRAMBLE

NSW Division's UHF sections
and 144 Mc May scramble, run
the evening for one hour, was won
arry Solomons, VK2AJZ, with 20
ts. VK2QZ and VK2AWF tied for
place with 19 contacts and in
place another tie between VK2LG
K2HE. Results of the autumn
ay were as follows: 1st: John Miller,
NF, with 1621 points; 2nd: VK2ATO,
Piddington, 748 points; and 3rd:
, at Mt. Canoblas, 746 points.

icity given in the daily Press to a
by Boy Scouts for an aircraft
g dropped during a flight in the
district gave the impression that
equipment suggested for use on
mmunicatoin side of the venture
be unsuitable. Equipment was
p for 3.5 Mc/s but during trials in
ea it was found that signals from
rtable equipment in the field were
factory, due mainly to the re-
t radiation from whip antennas.

job of communications was taken
y the UHF gang and Horry Lap-
VK2HL, and Cec. Cronin built up
e 144 Mc walkie-talkie equip-
(later to be used for
civil defence net working). During the weekend June 6th and 7th, the equipment was in use, and using home gear brought along by VK2HL the net was very successful. The home station, incidentally, was located in a tower 80 feet high, clear in many directions, and was heard in Singleton, Newcastle and Sydney.

CONGRATULATIONS to E. H. Cox, VK2GU, who received an OBE in the Coronation honors list for his services to Australian journalism. "Arch", a leading political newspaper correspondent in Canberra for many years, and president of the Press Gallery at Parliament House, is one of Australia's oldest and best known amateurs, particularly on the VHF bands.

In NSW country districts on 144 Mc much work is being performed. Bill Brook, VK2ACT, at Dubbo, will shortly have a 100-watt transmitter on the band. Norm Skulander, VK2JW, of Orange, is transmitting an excellent CW signal to VK2ANF in Sydney over the 120-mile mountain path. The main reason, a 16-element beam up 60 feet.

Presented to Allan Tollow, VK2AST, was the cup won by him at the UHF Field Day last year.

DX AND PERSONAL

THE final Voice of America radio amateur program was presented on May 18th. Gene Black, W2ESO, was the commentator in the absence of Bill Leonard, W2SKE, who a week previously had flown over to Germany.

These sessions presented in co-operation with the ARRL were commenced in June, 1949.

No specific reason was given for discontinuing the service, and it is hoped they will be reintroduced again.

Do not pass up SVOWG as just another station in Greece, in fact he is on Rhodes, in the Dodecanese. Previously he signed SV5UN and is operated by United Nations personnel on the island.

The general mix-up in amateur prefixes for North Borneo, VS5 versus ZC5, has been clarified by ex G5PC, an ex-PMG of that colony. The ZC5 prefix was issued some years ago and is quite legitimate for British North Borneo. Other changes and endorsements made by the British Colonial Office are as follows:—

VS2 and VS3: Both allocated to Malaya.
VS4: Sarawak.
VS5: Brunei.
VS7: Now the prefix for amateur radio stations operating in Ceylon has, too, been allocated for experimental stations in Malaya.
4P could possibly become the prefix for Ceylon amateur stations.
VS8: Allocated to experimental stations in British Honduras.
ZC1 and ZC6: Now cancelled. Experimental stations should not be confused with amateur stations.

YOUR OPPORTUNITY

the world-wide ranks of amateur
itters! The Wireless Institute of
lia holds regular classes in Sydney
t Sydney and suburban enthusiasts
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of Proficiency.

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A.O.C.P. CLASS

**e Victorian Division A.O.C.P.
s will commence on Thursday,
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orse and Regulations are held
Monday and Theory on Thurs-
evenings from 8 to 10 pm.
ons desirous of being en-
d should communicate with
**Secretary W.I.A., Victorian
sion, 191 Queen St., Mel-
ne.**

*ne FJ 6997 from 10 am to 4
or the Class Manager on
r of the above evenings.*

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NEW!

GS210. £9/3/6.

The A.W.A. RONETTE models R572/L and RFC/L with inbuilt transformer for use into low impedance long lines.

Study the economy of the following prices.

O-88 for fixed bracket mounts £8/12/-.

O-88F with flexible mount cable plug. £14/15/6.

O-88U for stand mount and cable plug. £10/5/6.

Models R474 £31/6/6.
R572 £18/19/9.
R572/L £22/4/9.
RFC £14/19/2.
RFC/L £19/-/-.

S742 £16/3/6

HM7 £7/3/6.

B110 £3/19/7.

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AMALGAMATED WIRELESS (AUSTRALASIA) LTD.
47 YORK STREET, SYDNEY, B0233 — 167 QUEEN STREET, MELBOURNE, MU9161.
AVAILABLE IN OTHER STATES FROM
NEWTON McLAREN LTD., ADELAIDE. NOYES BROS. (MELBOURNE) LTD., HOBART. CHANDLERS PTY. LTD., BRISBANE. NICHOLSONS LTD., PERTH.
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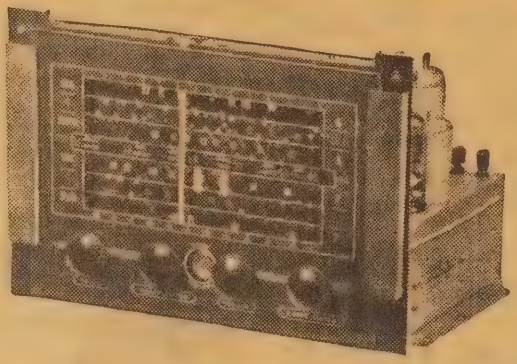
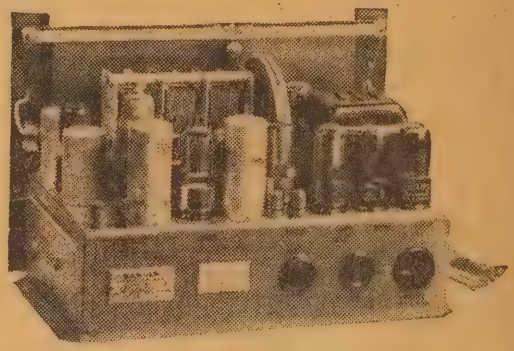
9-Valve De-Luxe Dual-Wave Radiogram-Chassis

Including Magic-Eye Tuning Indicator With Matched Dual Speakers

FREIGHT EXTRA





COMPARE THESE FEATURES

- Ultra modern circuit with new high gain valves and permatuned iron cored coils and intermediates giving good interstate reception and a short wave range of 12,000 miles.
- High gain audio with push-pull output and tone control gives you high fidelity reproduction from both radio and your favorite recordings. Inverse feedback incorporated.
- Power switch is fitted to the tone control of all chasses thus enabling the power to be completely switched off from the set. Radiogram switch combined with wave change switch.
- Tuning is made simple and positive even on overseas stations by the use of a super sensitive magic eye tuning indicator.
- All chasses are wired for the fitting of an F.M. tuner or Tape Recorder. Special plug on back of chassis being provided, also standard 3-pin socket for power supply to motor.
- Speakers supplied are Magnavox 12in and 8in permanent magnet with tropic proof transformer. Single 12in supplied with 7 valve chassis.
- Large calibrated edge lit dial in plate glass (11in x 7in) with main stations in each State in prominent type, fitted with counterweight drive and indicator lights on dial showing which band in operation.
- Dial can be supplied in cream or brown with matching knobs and escutcheon to suit blonde or walnut cabinets.

ALL CHASSES CARRY SIX MONTHS' GUARANTEE.

A New 10 Valve Dual-Wave Radiogram Chassis

The ideal chassis for those difficult locations where reception is doubtful

Specifications as nine valve unit but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

£38/15/-

7-VALVE WORLD-RANGE CHASSIS INCLUDING MAGIC-EYE

SPECIFICATIONS AS NINE VALVE UNIT, BUT WITH SINGLE 6V6GT OUTPUT VALVE AND SINGLE 12" SPEAKER

£27/15/-

FREIGHT EXTRA

Record Players and Changers

We have a complete range of 3 speed record playing equipment including B.S.R. or Garrard Players with turn-over crystal pick-ups or your choice of Garrard, Stromberg-Carlson, Collaro or the new B.S.R. 3 speed changer that will play 7, 10 or 12in records intermixed. All changes have turn-over Crystal pick-ups.

Large Variety of COMBINATION and CONSOLE CABINETS Available from £14

CLASSIC RADIO

245 Parramatta Rd.,
Haberfield, N.S.W.
Phone UA2145

EW TRANSMISSION LINES FOR VHF

(Continued from Page 39)

rably easier to construct, how-, and can be made by printed uit techniques or from commer-y available metal-plastic-metal inated materials by "stripping" metal foil from one side to the desired pattern.

s with the closed-strip type, the nd plane "outer" conductor is e at least three times the width he narrow strip. Transitions coaxial to open-strip line are difficult to manage and Q ors are lower. Typical dimen-s for a 50 ohm open-strip line conductor spacing .050 inch, width .250 inch, and ground e width .750 inch.

) The wire-above-ground system imilar to the open-strip variety hat it is an unbalanced system ch exhibits low Q because of er radiation losses. It usually loys air as a dielectric and main-s the proper spacing above the nd plane by the use of dielec-beads at intervals.

s main advantages lie in its plicity and its higher power hand-capacity than the open-strip because of the rounded con-tor. It cannot be made con-iently by printed circuit methods. ypical 50 ohm line would consist 1/8in copper wire spaced .025in ve a ground plane.

he losses in the new strip-type smission lines are lower than e of solid dielectric cable but ier than rectangular waveguide air dielectric. Their greater pactness, elimination of precision hining, and economy, are ex-ed to make them very useful, cially for within-the-chassis rowave wiring where size re-tion is important and the metal ssis can serve as the ground ne.

ADAR TECHNIQUES

(Continued from Page 63)

siderably. Each has certain dis-antages not inherent in the other. important characteristics may be pared as follows:

a) EFFICIENCY: The thyratron is inherently the most efficient. equires fewer stages and conse-tly less drain from power source. voltage drop in the switch tube ess than in the hard tube case, lting in less power dissipation.

b) IMPEDANCE SENSITIVITY. hard tube modulator has the antage in this respect since it operate fairly efficiently into impedances varying over a wide ge. For good efficiency and satis-ory pulse shape, the line type er must match the load imped-e to within about 30 pc. Thus, line modulator has a disadvan-e in applications where many gnetron types are encountered, as laboratory testing.

c) ADAPTABILITY. The hard e modulator is the most adapt-e to different pulse durations and etition rates. Since the pulses formed at low level small com-ents can be switched for varying se durations. In the line pulser pulse forming network, and, in ne instances, the pulse transfor-mer, must be changed to effect a change in pulse duration. In addition, the pulse line is usually designed for operation only over a small range of repetition rates.

(d) VOLTAGE REQUIREMENTS: The thyratron modulator requires a lower voltage dc supply since the pulse transformer steps the pulse voltage up to the required level. In the hard tube system, the dc source must furnish a dc voltage equal to the required pulse voltage.

(e) ARCING BEHAVIOR. In case of internal magnetron arcing, the hard tube modulator is more severe than the thyatrom type since the entire charge of the storage capacitor can discharge through the magnetron, with damaging effects on the magnetron cathode. The energy stored in the pulse forming network, on the other hand, is only the amount required for each pulse.

As a result of these characteristics, the thyratron pulser is usually favored for field radar applications where its greater efficiency, simplicity, and light weight give it the advantage. The hard tube modulator is useful in laboratory applications because of its versatility and in instances where very high repetition rates make the gas tube type inapplicable. (By courtesy of the Aerovox Corporation. To be continued.)

When you have an awkward parcel

A little "Bear Tape" will do hundreds of every-day jobs more quickly and easily. It seals at the pressure of a finger and hugs like a bear. *It's better! It's the only tape specially made to suit the Australian climate!* You can count on "Bear Tape" for easy, economical, instant aid . . . in office, home and workshop.

seals tighter!
mends better!
holds faster!

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BRAND
TAPE

Made in Australia by
BEHR-MANNING
(AUST.) PTY. LTD.
Manufacturers of
Surface Coated Abrasives, Pressure Sensitive Tapes, Adhesives and Coatings

M70A

OFF THE RECORD — NEWS & REVIEWS

In the field of movie entertainment, a highly interesting and important controversy and experiment is going on with 3-dimensional and wide-screen projection, under various titles. Many Australians have already had a chance to see them and form their own opinions. What has this to do with sound? Plenty—and on a smaller scale, there is an exactly parallel examination going on at the moment.

By JOHN MOYLE

IF you have been reading literature on the subject, and some articles have and are appearing in our own magazine, you will have some idea about the differences, and similarities if any, between what can be considered the true "3-D" and mere extension in size of the movie screen upon which the pictures are projected.

The wide-screen technique isn't hard to understand, because fundamentally it's just what the words imply. The image is bigger (if not better) and spread out so that we can literally examine it yard by yard, instead of taking it all in at one glance. We can, as never before, begin to place objects in two dimensions because the picture is spread out over such a large area. In advanced examples of this technique, the screen is very large and appreciably curved, so that the picture comes at us from both sides and the middle. We just couldn't look at it all at once even if we tried.

But the 3-D picture is entirely different, even though it might use a big screen. It depends on the projection of two images as they would be seen, one by each eye, were we present when the picture was taken. To view the film, we use special glasses which allow each eye to see only one of the pictures. This process, which I needn't elaborate here, gives the same illusion of depth made possible by the fact that we have two eyes. When observing the world in general, we see it as two pictures, each slightly different in aspect and perspective. When these two are brought together in the brain, they allow us to separate out those things which are close from those which are far away.

3-D AND SOUND

Now I'm withstanding the temptation which has overcome Mr. Williams in his "Argument" pages to make forecasts or to assess the future of 3-D pictures and wide-screen pictures. For the purposes of what I mean to say, it is sufficient to record that the 3-D pictures, with all their teething troubles, do add this third dimension most effectively, as many of the audience testify when they find a spear suddenly thrust under their very noses, or a ping-pong ball scraping the breakfast egg off their Sunday ties.

Again, what has this to do with sound? Everything, because of the simple fact that in addition to a pair of eyes, we also have a pair of ears. Just as we can appreciate realism in two dimensions with one eye, we can do the same, more or less, with one ear. And just as we can appreciate three dimensions when seeing with both eyes separate pictures taken with two cameras, so can we hear three dimensions if we hear with separate ears the sounds from two sound channels, each originating in a microphone separated by the same distance as our ears, and picking up sound from the same area in space.

BINAURAL HEARING

There should be no mistake on this point. For 3-D hearing—"binaural" hearing as it is termed, we must have these two channels. The microphones should be spaced apart as our ears are spaced, with some device such as a pair of headphones to deliver the final result to each ear separately. Once both ears are allowed to hear both sounds, the effect will be destroyed.

This 3-D sound idea isn't new any more than 3-D pictures are new. Any more than two-dimension or wide screen sound is new. I was only one interested enough to make some experiments in these things m years ago—about 15 to be exact. improvements and additions sound facilities, such as tape rec ings, have made such work eas and brought practical applicati nearer. I was, therefore, greatly terested to read the results of servations made recently in Ame to analyse some of these ideas.

SIMPLE TEST

You can test this 3-D hea very easily by plugging one with your finger and noting the sult. Not only will you imm ately find that your hearing has its ability to select one sound f many, but you will not be to estimate accurately sound tances as you could before. If make a parallel test by covering one eye, you'll experience the s result in the optical sphere.

And here I must refer again some remarks by Mr. William few months ago again in his ubi tous "argument" pages, where covered this field quite fully. L them up, if you have a back c

It should be very clear now t without the use of binaural eq ment, we can never hope to re duce a duplicate of what went in the concert hall. I have alw disagreed with this conception recorded music on every poss ground. It is basically impossi and psychologically frustrating. most we can do with our sin point speakers is to produce cl clear music from clean, clear o inals in such a way that we get most pleasure from the resul sounds. Our own imagination s plies enough realism from exp ence and emotional (and/or men reactions to fill in the sound ture. But to imagine that the chestra is actually in the room never.

WIDE-SCREEN SOUND

At this stage, I'd like a few wo about "wide-screen" sound. might be regarded as the first in improving or glamorising results in two dimensions. single-point reproduction is ba there's no denying that. Unfort ately, most of us must put up it for lack of space. The obvi step in avoiding it is to use mult speakers to "increase the width the screen"—to spread out the sou of the sound we are hearing.

This can be quite successful the room is big enough and fav ably shaped. The spacing can several feet, and the speaker ov lap tends to fill in the separat space if it's not too great. But jus in the theatre we can't sit too r the large screen, we must ope our speakers at the far end o

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big room if the fusion of sound be complete. I'm not con- at the moment with compli- of the idea—only with the le.

, however, doesn't really give -dimension sound. We can't ne basses as playing here, and ccolos there. All we can say they all come from "some- over there" and not merely that point".

DIMENSIONS

get a two-dimensional effect— phonic" is a term often used could use two channels with ted microphones during re- g, and two speakers well sepa- during reproduction. If one hone were appreciably nearer nstruments than the other, our uction would tend to place the nents to one side or the other, case may be. I remember stem demonstrated in Sydney the war by Raymond Allsop, sed twin theatre equipments oduce an orchestra playing in r hall, and to show wide- films of a ping-pong match. though the effect was strik- was not binaural—it had no

her method to obtain this two- ional effect is the one I used, ng three speaker systems will do), spaced up to 10ft in a big room. To the left the "woofers" or low-note rs, in the centre the middle- speakers, and the "tweeters" e to their right. Frequency tion was not sharp, and ob- by a combination of electrical oustical filters.

"stereoscopic reproduction", alled it, was quite striking in t could separate a violin or from the accompanying piano, ouble-basses from the wood- and so on. I thought it a ep from merely duplicating rs, and was brave enough to paper on it before the local The separation was artificial, ccasionally incongruous, but extremely simple and worked

TEP

next step to true binaural lis- is a vast one, and is sur- ed with the same dilemma as D pictures. At present, I can o full substitution for the glasses required for 3-D, nor bstitution for headphones. You an't mix up those two sound els, which means also that a f pickups running on double- records would be needed, or rack tapes, each track carry- separate sound channel. Sure methods will work, and such have been made. But will n people be interested to war- he equipment and to accept eadphones?

ink quite a few would, but more would be needed to en- e big record firms, for in- to spend money on the idea. the movie firms aren't putting uch into 3-D until they decide er John Citizen will go for the glasses, or whether he can be ed with anything better than got.

just as the results of 3-D es hit me fairly between the so that flat pictures will always be lacking in realism for me in the future, so I am sure would binaural sound. With lightweight, full-range headphones—and I once had a pair of cone-diaphragmed, crystal phones weighing only a few ounces and with an incredible response—the sound realism I believe would be just as striking as 3-D pictures.

For the first time, it would be possible to sit back in your chair, and bring that orchestra right into the room, with the rest of the world shut off from your hearing. You have never really heard bass notes as they can be heard with headphones closely coupled to your ears with no vented enclosures or loading horns (or £30 speakers!) to worry about. No 30-watt amplifier and what not—just a simple two or three-valve amplifier with negligible distortion. Now that we have long-playing records, twin-track recording would still give up to 15 minutes' duration. Double-track tapes would do even better than this.

The tape idea would be quite within the capabilities of many experimenters, even within my own. Must try it some time.

Will these ideas ever come to anything? I think some day they might. As we exhaust each new development in such fields, others must be taken up and tested for audience reaction. Mind you, we would become very fussy at this point. Don't you agree, for instance, that 3-D films are a washout without natural —I said natural—color? We couldn't tolerate anything but perfect sound, with no crackles or surface noises. Balance must be perfect, too, and performances first-class.

But would I go for it! Somehow I think you might, too.

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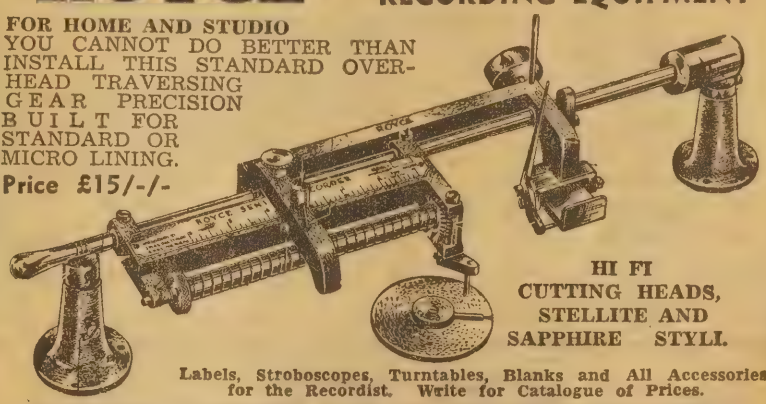

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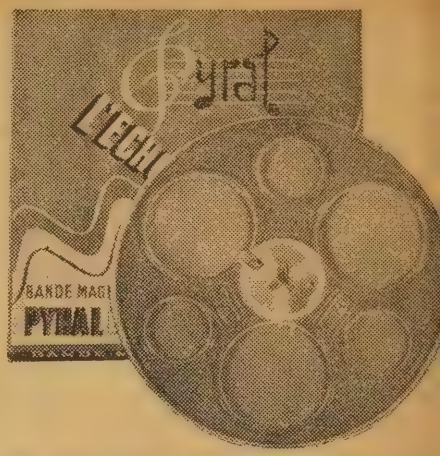

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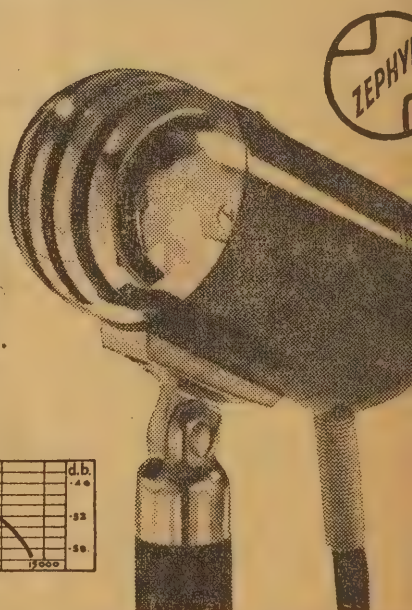

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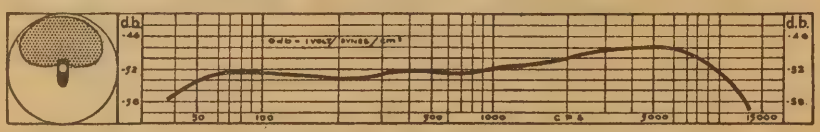

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OM THE SERVICEMAN WHO TELLS

(Continued from Page 45)

eeing cables which would en-
ıe to reach the "works".
n I did and was able to meas-
e HT voltage I was surprised
i that it was around the 280
which was perfectly normal
amplifier of this type. Fur-
ɔre, all the other voltages, and
icular the 6V6 bias, were quite
l, and it was obvious that the
e was more deep-seated.

r probing around the various
I was forced to the conclu-
ıat the trouble was in the out-
ıge, though I must admit that
ıing had me baffled at this
Thinking that there must be
kind of obscure fault in one,
h, of the output valves, I re-
one from its socket, intending
ɔlace it with a known good

TO NORMAL

ıediately the valve was out of
cket the gain jumped to a nor-
gure, dropping again when the
was replaced. Removing the
valve had exactly the same
and I began to suspect the
tions between the amplifier
ıe speaker. What particularly
ed my attention was the
r cable, and the fact that it
cently had an additional length
spliced into it.
the more conventional ar-
ıent, where the speaker trans-
is mounted on the chassis
ıe leads to the speaker are
ed at voice coil impedance,
s not much chance for error,
this case the transformer was
ed on the speaker and the
tion to the amplifier made by
of a three-wire cable. It only
few minutes with the ohm-
to confirm what I suspected,
, that in extending the speaker
someone, presumably the
had transposed the connec-

manner in which the trans-
was now connected suggest-
ıe freakish new push-pull sys-
ıe creation of a highly-strung
ɔr whose reason had snapped
result of overwork. In more
terms, it was as follows: One
the transformer went to one
ate (which was correct), the
end of the transformer went
and the centre tap went to
ıer 6V6 plate.

JT CANCELLED

arrangement "sort of gum-
p" the phase relationship be-
the two output valves, so that
were effectively opposing,
than aiding, each other. No
there wasn't much output.
ı here, of course, it was plain
I simply transposed the two
ng leads and the amplifier
ned as well as ever. But it
have saved a lot of time if
ɔeen told that the failure only
ed after someone had at-
d to extend the speaker cable.
finally a brief comment about
tly heated rectifiers, the 6X5
ticular. When these valves
irst introduced, they were
unreliable, the main defect
heater-cathode breakdown.
ıe passage of time the makers
to have overcome this prob-
lem in a large measure, so that it is now no more frequent than most other structural defects.

However, I encountered a completely new fault recently when I discovered that the HT voltage of a receiver was down and turned my attention to the 6X5. In this case the filament appeared to have burst through the pinch at the top of the cathode sleeve and, in the absence of anything to restrain it, had apparently been forced up from underneath by expansion due to heat, so that there was now about half an inch of filament spiral protruding from the top of the cathode sleeve.

Quite obviously the heat being generated in this part of the filament was completely wasted as far as the cathode was concerned, so it was little wonder that the valve failed to meet the full HT requirements. Commenting on this with some of my colleagues, I learnt that my case was by no means unique and that several such cases had been experienced.

However, it did seem that mine was about the worst that had been seen, most of the others having only a small amount of filament protruding and being still capable of normal performance, although there was no guarantee that this condition would not worsen in the course of time.

Not being a valve expert, I cannot be too definite as to the cause of this fault, but it would appear to be mainly due to a failure to pinch or seal the end of the cathode sleeve correctly. Doubtless this is just another of the many production problems which beset the valve manufacturer, and it is to be hoped that it will be solved before it assumes serious proportions.

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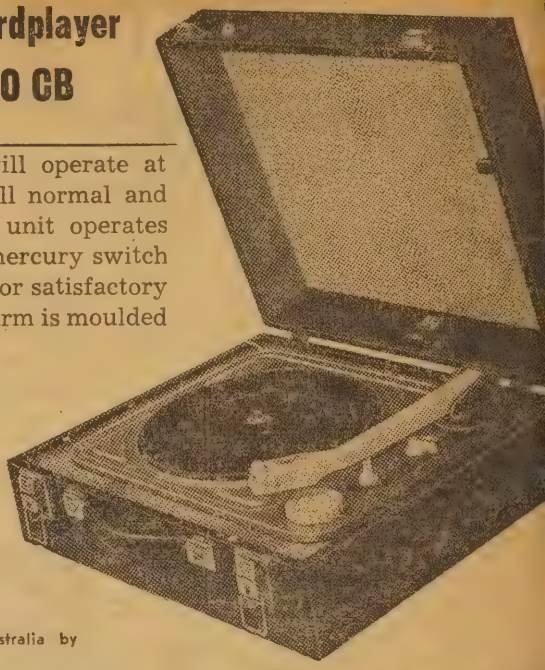

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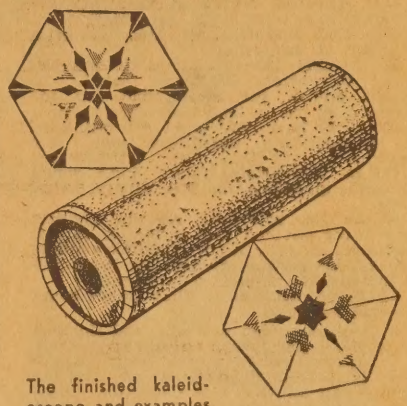
CLI

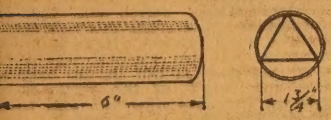
HOW TO MAKE A KALEIDOSCOPE

kaleidoscope is a most attractive little toy, and the variety and ıber of charming colored designs obtainable from one are really ıarkable. The heading sketch shows a completed kaleidoscope with examples of the kind of design that can be made.



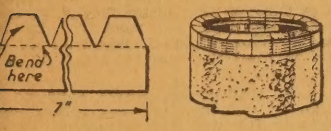
The finished kaleidoscope and examples of patterns produced.

ST procure a piece of ordinary ardboard tubing, 6in long and ı diameter (see Fig. 1), and his slide three pieces of glass 5¾in long by 1¾in wide to form ngle, as shown in Fig. 2.



1 (left):—The cardboard cylinder. 2 (right):—The glass fitted into the cylinder.

e surface of each piece of glass be painted over with black or other paint, and care must ken when inserting them into ube that the painted sides are most.



3. How the paper is cut to hold disc in position. Fig. 4. The flat of card placed on one end of the cylinder.

er one end of the tube lay a stout oard disc, in the centre of which a ½in diameter hole through to look.

hold this disc to the tubing, cut p of stout brown paper about ong and ½in in width, and at ide of this form a series of s, as Fig. 3, so that when the is glued around the tube, the o formed will turn down on to ard disc and hold it firmly in

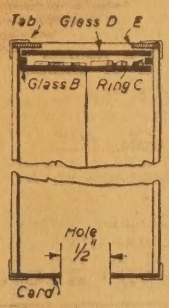
OTHER END

w turn your attention to the end of the tube. The three s of glass having been insertest on the card disc just re- to, and leave a ¼in or so nce between the glasses and op of the tube.

Procure a circular clear glass, the same diameter as the inside of the tube, and lay this on the three glasses. Cut a ring of stout card about 1-8in wide with an outside diameter the same as that of the glass disc and lay it on top of the clear glass.

Now insert a piece of frosted glass of the same diameter as the clear piece, and see that this lies flush with the top of the tube.

Remove this top (frosted) piece of glass and insert a number of pieces of colored glass or clear colored celluloid of any odd shape and size, afterwards replacing the top glass. Next cut a flat ring of card, lay this on top of the glass, and securely fix it to the tube in a manner similar to the opposite end, as shown in Fig. 4.



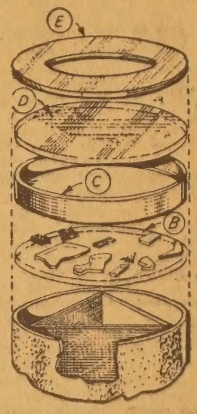


Fig. 5. The position of all the parts, and (right) Fig. 6. How each piece is inserted.

The section Fig. 5 shows clearly the position of all parts, while Fig. 6 illustrates the manner of inserting each piece.

To use the kaleidoscope, hold it up to the light, look through the spy hole and then gently turn it.

Design saves time

SE of maintenance designed into a new 4-wheel-drive-jeep allowed ıe soldier-mechanics to remove the ıplete engine power package in 3 20 sec. Ease of maintenance is ıg extended to other US Army icles from trucks up to tanks, tors, graders, cranes and power vels.

HOW THEATRES SHOW NEW FILMS

(Continued from Page 7)

jectors. Film companies supply projectionists with printed instructions on aligning their machines preparatory to running a 3D feature.

Special screens have had to be evolved to retain correct light polarisation. Current practice is to use an aluminium-sprayed plastic sheet, which unfortunately reflects less light than a plain white sheet.

MORE LIGHT?

This loss of light, coupled with the loss in the filters and viewing glasses, has projectionists worried and may necessitate more powerful illumination if 3D becomes generally accepted.

The current counter-attraction of the "panoramic" screen being achieved by the simple expedient of using a shorter focal length lens and "blowing up" the picture to a larger size.

At the same time, the film gate in the projector is replaced by one giving a somewhat wider and narrower picture as illustrated. One or two of the films have been photographed to provide for this procedure, by allowing a generous amount of room at the top and bottom.

Even so, however, heads and feet are likely to disappear at times unless the projectionist is ready to ease the framing lever up or down by an appropriate amount.

Many scenes are greatly enhanced by the wide screen treatment but others suffer. Telephoto shots and such like look very flat by reason of the increased perspective distortion.

The ultimate screen size depends a lot on the construction of the theatre and available standard lenses. The screen is curved back a few feet in the centre to maintain better overall focus and tilted back at the top to serve the circle seats.

Due to the enlargement, some of the front stall seats are impossibly close to the screen and, in most cases, it has been necessary to remove some of the front rows, representing a loss of revenue.

TECHNICAL PROBLEMS

Indications are that the true wide screen systems have bogged down for the time being. The three-projector Cinerama systems look like being too costly, while the difficulty of producing accurate lenses has delayed the promising Cinemascope idea.

According to movie interests, the present trend to larger screens may be maintained, supported by the impending use of magnetic rather than optical tracks. This may clear the way for sound having wider response and dynamic range with a stereophonic system possibly thrown in for good measure.

ANSWERS TO CORRESPONDENTS

G.B. (Leeton, NSW) in renewing his subscription writes in appreciation of Radio and Hobbies. He also makes a number of suggestions.

A. Thanks indeed for your interest. Your suggestion about an article on sound effects for those who are interested in using tape recorders to produce plays is a good one. We will give it consideration over the next few months.

D.R.B. (Northcote, South Vic.) sends in some questions for the Answer Tom page.

A. As you will note, Answer Tom is now being devoted to a series on valves. However, as your letter contains a number of interesting queries we will file it for consideration at a later date.

V.E.H. (Thomastown, Vic.) makes some general inquiries.

A. A subscription to Radio and Hobbies costs 18/- per year including postage. It is an excellent idea because the magazine is posted direct to your address saving you all worry of collection, missing out on some issues, &c. A few copies of the February, 1953, issue are available and if you write soon we will be able to supply one. The cost, including postage, is 1/6 plus 1d per month that the issue is out of date. We can supply circuits of several crystal sets through the 2/- query service but regret that the issues containing the descriptive articles are now out of print.

L.J. (Inala, Qld.) asks about the circuit of a walkie-talkie.

A. Assuming you mean a hand portable transmitter/receiver, you may be interested in the "Handie Talkie for Amateurs" which was described in the October, 1950, issue of Radio and Hobbies. This unit was intended as a guide for licenced amateurs who wish to conduct experiments on the 144 Mc amateur band. We can supply a copy of the circuit and a few photographs of our experimental model through the 2/- query service but no other information is available.

R.C. (Cootamundra, NSW): asks for our comments on his amplifier. He supplies a series of voltage readings taken at the voice coil winding. The signal source was a frequency test record and a crystal pickup.

A. When assessing the performance of an amplifier it is usual to talk in terms of decibels rather than voltage ratios. The number of decibels change from the reference level can be obtained from the ratio of the measured voltage to the reference voltage, taking the logarithm of this number to the base 10 and multiplying by 20. For example, if your reference figure is 2 volts and the new figure 4 volts, the ratio of voltages is 2 to 1. Log. 2 to the base 10 is .301. Therefore there is a change of 6.02 decibels. As the test record you used is recorded at different levels at different frequencies it is necessary to obtain a corrected figure. Simply add or subtract the figure given on the test record as necessary. A rough check with the figures set out in your letter suggest that the amplifier and pickup combination is within about 4 db over the range of 50 to 9000 cps and about 6 db down at 10,000 cps. As 3 db is the smallest change normally detectable by ear the performance of the system would appear to be fairly good. It is very difficult of course to assess the probable error of the voltage measurements and also the effect of changes in the impedance of the speaker voice coil with frequency.

R.S. (Suva, Fiji) (and a number of others) encloses a number of questions for the Answer Tom feature.

A. At the present time, this feature is being devoted to a discussion on valves. We will therefore file your letter for consideration at a later date.

N.S.K. (Auburn, NSW) asks a question on amplifiers and two questions on frequency meters.

A. The subject of volume compression and expansion is discussed authoritatively in the 4th edition of the Radiotron Designers' Handbook and the best we can do is to refer you to this publication. Volume compression is frequently applied to broadcast and recorded programs so the chances are that the programs you refer to have less than the original dynamic range. A frequency meter suitable for radio amateurs was described in the August, 1949, issue of Radio and Hobbies. It was found more practical to cover the various ranges by means of harmonics rather than on fundamentals. It does not cover the broadcast band. As you suggest, a mixer valve could be included in an ordinary service oscillator to enable it to be used as a frequency meter. The modulation of the oscillator would be switched off and its frequency adjusted to "zero beat" with the unknown. The oscillato then reads the frequency of th known. However, the order of ac obtainable with such an arrang would probably not be good enou frequency measurements on the an bands.

D.S. (Torrensville, SA): Send in tribution for possible publication Reader Built It section of the ma

A.: We thank you for your lette The circuit which you enclose has published in various similar forms past. However, we are filing it fo sible use at a later date.

G.W. (Wollongong, NSW) has bu three valve set described in the " Yourself Radio" series and finds it successful apart from interference by the local station. He wants to whether we can suggest any rem

A. As pointed out in the origina icle, the length of the aerial is a portant in cases like this and muc be done to improve matters by juc adjustment of the aerial length. is plenty of room for experiment If it is found that the local statio only be controlled at the expen more distant stations it may be while constructing a wave trap. consists of a tuned circuit compris coil and variable capacitor in paralle capable of tuning to the frequency offending station. This is connecte tween the aerial lead-in and the re aerial terminal and adjusted to r the strength of the unwanted statio minimum. This is best done by t the set to the station and then adj the trap until the strength drops s ly. When it is reduced to a min the trap is left permanently on thi ting and the set used in the n way. The effect of the trap on s other than the one to which it is is negligible.

L.H. (Lidcombe, NSW) says he like to see the full description and results for the R-J enclosure. It be especially valuable to those who not easily house the larger varieti their lounge rooms.

A. We would like to make an mediate promise but time is our present enemy. Just as soon as we organise the carpentry work and necessary time to do the tests, we publish more information on the ject. In the meantime, you shoul able to get very close to the mark the overseas information already printed.

R.C.M (Cryon) says that he has aged to overcome generator hash lems in his 32-volt receiver and is very happy with its performance. has also managed to get hold of speed gramo motor suitable for 3 operation but has yet to try it o 33 rpm.

A. We are pleased that you have able to clear up all your interfe problems. We agree that the vo regulation problem is a nasty one the use of a voltmeter and series tor appears to be the only sure wa of it. The feedback resistor for No. 2 Playmaster could be about ohms or slightly less for the 6-ohm coil.

J.E.W. (Dubbo, NSW) advises change of address. He comments f ably on Radio and Hobbies except he feels that we are not sufficiently cal of goods treated in the "Trade views and Releases" section.

A. Your new address noted. which we do not think are up to st ard are unlikely to receive mentio the Trade Review section so that yo not likely to read any strongly ad comments. On the other hand, u we have been able to test the e ment under appropriate conditions, content ourselves with summarising are clearly stated as the "man turer's claims." The purpose of the tion is to give you a summary of releases pointing out any features I to be of interest. If you wish to chase, it is up to you to make your detailed investigation.

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ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

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To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

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ATEUR RECEIVER

(Continued from Page 61)

use the BFO uses an IFT coil d for 465 Kc, it must be cap- being correctly tuned. Set O pitch control condenser to ale, tune in a steady signal band and switch to the CW . Adjustment of the BFO coil r or slug, whichever is appro- will produce at some setting iliar CW heterodyne note. Set ljustment to give zero beat. and operated condenser will llow you to vary the beat side of the carrier at will.

BFO output is injected into ector diode by a tiny capaci- nade by hooking together two ed leads, one from the diode e other from the BFO grid. st enough coupling to give a eat. Too much is undesirable, ll make the set noisy on CW. your adjustment for fairly signals.

INISHED SET

t be worried because the set produce a loud hiss when "flat" without an aerial, al- it should sound "lively". the aerial is connected, you hear plenty of strong sig- ncluding the 6 Mc broadcast s at the far end of the 7 al setting.

length and direction of the will also make a big differ- nd is worth some experiment.

ll find this set very smooth easant to use. It doesn't bel- you between stations after the r of a 13-valver, nor will it in the entire suburb except stronger signals. But it will you to hear everything worth on both hands by flipping vitch, and isn't in the least

t discount it because it's sim- t's already in a spot on our r rack, and it's going to stay

---

s buy an argument

(Continued from Page 43)

alue by common agreement. ct that there have been sev- such "common agreements" imposes the obligation to de- e reference which applies to ven usage of absolute values. ransposing a formula, decibels o be used to express voltage on the assumption that they to circuits of equivalent im- e—a figure that should ideally ted.

udio voltage amplifiers, how- he circuit impedance is usually ondary interest, attention be- cused on the signal amplitude appears at the various grids. ative feedback circuits are an- nstance of where db are com- used to express ratios of gain on, without any thought ver of impedance values.

ll this is the basis of J.D.C.'s m, then we stand condemned, with a lot of other technical ire. But it's so convenient radioman's point of view that t if we'll ever mend our ways. a pity the space ran out or ight have developed into an ative article on the subject. 's still time!

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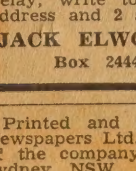

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Cost of Classified advertisements in this section is 2/- per line, approximately five words to a line. Closing date for August issue of Radio and Hobbies is Wednesday, July 15.

FOR SALE: Advance Signal Generator Model E2, covers to 100 mcs. Excellent condition, £30, or would exchange for Enlarger or Camera. C.G., 57 Napier Crescent, Essendon, Vic. FU5601.

FOR SALE: Williamson Amplifier Parts, complete or separate. Cheap. UY8056.

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FOR SALE: 14 reels of 16mm Silent Film with cans and reels. Buy lot, £35. C. C. Chapman, Box 34, Railway Town, Broken Hill, N.S.W.

FOR SALE: ARB American Communication Receiver, converted to 240v. A.C. Complete with speaker in working order, £15. Also 5v. Radiogram, 3 speed S/C Changer and 5v. Portable, both new condition, cheap. Johansen, 263 Stoney Creek Rd., Kingsgrove.

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FOR SALE: Any reasonable offer for 30 copies R. & H. from Nov., 1950, to this. D. Dennis, Coolangatta, Qld.

SALE, Exchange: Hallicrafter's S27 Receiver, 14 tube 28-142 mcs. per sec. AM, FM, &c. AWA12 R7490 Signal Generator, 50-100 mcs. per sec. with calibration. TRF 6-valve Receiver, 46051A—3 coil boxes. American wire-wound 2 and 4 decade Resistance Boxes. Offers to Hayman, 5 Melville St., Claremont, W.A.

SALE: 110 copies R & H, 1940- copies Eng. m'cycle mag. Offe Transceiver C. Anderson, Zeeha

SELL: M.V.A. Multimeter, new, bound vols. R.H. from 1940, £5. Amateur Photography, 50/-. Collar Motor P.U., £2. 10 asst. Radio Bool Lot £20. Box 6812, R. & Hobbies.

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WANTED: Communications Re full particulars and price to Bo Sun Advg., Sydney.

FIDELITY OR DX AS REQUIR

(Continued from Page 35)

coupling for this operation in order that the local station may provide a weak, but steady, signal just sufficient to operate the AVC meter.

The final adjustment is that of the whistle filter circuit. Select a tuning position where a 10 Kc whistle is very obvious and adjust the slug in the filter coil until a drop in output is noted, then adjust the potentiometer until a further drop, considerable this time, is noted. Now recheck both adjustments till the whistle is no longer heard. The filter circuit is now correctly adjusted.

If there is difficulty in finding a position for the slug which will effect the whistle, the setting of the potentiometer should be changed slightly and the slug adjusted throughout its range again. If no response is obtained after trying a reasonable number of potentiometer settings it may be that the filter is not capable of tuning to 10 Kc, due to a combination of tolerance errors in the filter coil and the .005 mfd capacitors. A little trial and error experiment with values in either direction should enable the builder to tune the circuit correctly.

From the circuit it will be noted that the output from the whistle filter circuit is taken to a voltage divider network before being passed on to the following amplifier network. Whether this network will be required or not, or the final form it will take, will depend on individual requirements, and a few words about the possible combinations will in the final selection.

Without the 250 pf capacit combination simply serves to the audio output, and this ma vide a measure of convenie certain circumstances. In the of the Playmaster control units is a volume control which wil vent overload, but a high inpu result in inconvenient settings volume control. Correct adjus of the network will remedy

The 250 pf capacitor acros .1 megohm resistor makes the ing network frequency consciou provides a measure of top bo assist the frequency response extreme top end where the eff side band cutting begins to b Whether you need this or n pends on a number of factor cluding the type of IF transf you use in the first position a amount of loading which can b erated in your particular locat

For the curve shown in th companying graph we used n boost at all, but both primar secondary windings of the fi were loaded with a .05 megoh sistor. In locations where th gree of loading is excessive t sponse will be somewhat nar and the additional top boost then be useful. Alternatively serve to compensate for losses in the audio equipment, lifier, speaker, &c., even whe tuner response is correct.